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SOME PHENOMENA OF WIRELESS SIGNALS.

The valuable paper by Messrs. Dolbear and Proctor printed elsewhere in this issue deals with a subject which is, as intimated in a recent editorial, of particular interest and importance. The general fact that wireless signals over any considerable distance are more effective by night than by day is a very familiar one. That this difference is on the whole less marked when sending long wave lengths than when sending short ones, and also less marked when sending north and south than when sending east and west, are facts which were well brought out in the lecture by Mr. Marconi, to which we referred in a recent issue. The present paper deals with the further and quantitative examination of some of these phenomena and throws considerable light on their underlying causes, although, as the authors very properly indicate, there are many irregularities in wireless sending of which no rational account can yet be taken. The main phenomena brought out in their investigations are the extraordinary and abrupt variations of the strength of signals which occur at sunrise and sunset. In their experiments the signals recorded between Glace Bay and Boston were practically obliterated at a period usually about five minutes after sunset or sunrise and then within a few minutes recovered almost their normal intensity. The signals by night were, on the whole, although irregular, stronger than those by day, but the change between night and day was small compared with the violent variations which occurred when the point of sunset or sunrise fell in longitude between the stations or close to either of them. It is substantially the same phenomenon shown in Mr. Marconi's lecture, but much more vividly here, perhaps on account of the fact that the stations under investigation differed so little in longitude, approximately twenty minutes of time. There is also shown a distinct difference between the duration of the sunset and sunrise periods of weak signals, the former being always the wider. As Messrs. Dolbear and Proctor remark, the general phenomena may be explained in a fairly satisfactory way by the ionization of the air by sunlight, producing a dissipation of energy by air conduction through the ionized space. It may be pertinent, therefore, to inquire into the cause of the ionization and its probable location in the atmosphere.

It is well known that the solar wave lengths less than about 300 $\mu\mu$ are practically obliterated by the absorption of the atmosphere. This absorption is certainly accompanied by powerful ionization, since rays of this wave length and less are well known to produce this effect in the laboratory. The absorption and incidentally the ionization increase rapidly as the wave length diminishes. The most active effects are produced by wave lengths of less than 200 $\mu\mu$, such as are absorbed by a few meters or even

decimeters of air at atmospheric pressure. None of these particular waves from the sun get anywhere near the earth, as has been well shown by the researches of Cornu and others regarding the extent of the solar spectrum at high altitudes. Even at heights of 12,000 ft. or 15,000 ft. no perceptible wave lengths less than 290 $\mu\mu$ get through, so that all the shorter wave lengths are absorbed above this level. In a very rare atmosphere, such as exists at extreme heights, the absorption is much less rapid than near atmospheric pressure, so that into the thin upper regions the extreme ultra-violet waves can penetrate for a considerable distance and produce strong ionization and conductivity. This is very well exhibited by the conditions which exist during auroral discharges, which seem commonly to occur, according to recent investigations, at a height somewhat in excess of 100 km above the earth's surface. In this region the effect of ionization is very marked in easy conductivity. How much further down it extends and what is the distribution of ionized material it is impossible now to say, but the condition which exists when the ultra-violet solar rays strike the atmosphere is certainly one which in the higher atmospheric strata would favor the rapid dissipation of energy by conduction. The extreme outer layers from their low density would be less effective in dissipating energy than those lying at some point lower down at which the conductivity due to ionization would become a maximum. Below this again the conductivity would diminish owing to the lessened effect of the rays that get through, and finally a condition of relative stability would be reached at some point not many kilometers above the earth's surface. As sunrise draws near the upper strata of the atmosphere are rendered strongly conducting and the rays finally break through into visible sunrise, leaving behind them and above the point of sunrise a great conducting mass of ionized air, extremely heterogeneous in conductivity owing to the effects of rarefaction and varying absorption of the rays. In a gaseous mass of this character the distortion of the wave front suggested by Fleming must almost certainly take place, as in the case of every wave front which impinges upon a region of varying dynamical constants. It is not perhaps so much reflection or refraction in the ordinary sense as general distortion owing to the irregular dissipation of energy.

When the whole region between the sending and receiving station is light, the distribution of conductivity, while irregular in altitude, should be fairly homogeneous, so that while the signals may be attenuated the wave fronts are not so distorted and broken up as in the previous case. At sunset the conditions of distortion recur again, but in the reverse direction in space, so that one would naturally expect a difference in the phenomena, and such a difference, indeed, appears in the data before us. The sharp rise in the strength of signals shortly after the sunrise and sunset minimum would suggest that the maximum wave distortion occurs just as the area of maximum disturbance is passing over the station, and that the earlier condition is resumed after the storm has passed, so to speak, to be thereafter more slowly changed by the general increase or decrease in ionization in daylight or darkness. The data so far presented seem therefore to fit excellently well the ionization theory often propounded. There are, of course, many details as yet unexplained, but such admirable experimental researches as those of Messrs. Dolbear and Proctor will, if continued, throw a great deal of light on these extremely interesting phenomena. They may even enable us to learn something more of the distribution of the atmosphere above the earth and the laws of its electrical conductivity.

THE PRESERVATION OF EYESIGHT.

The recently formed American Association for the Conservation of Vision has cut out for itself a somewhat formidable task in attempting to reach the multifarious causes of injury to vision. The purely medical activities with which it has begun operations are already making themselves felt, and we hope as much for those efforts which are to be directed toward the amelioration of lighting conditions. Just what the function of the association is to be in respect to lighting reform it is perhaps a little early to say, but it can at least prove immensely useful as a sort of clearing house for data and for co-ordinating the activities of other societies and committees working along similar lines. One thing at least is certain—that there is plenty of bad illumination which needs reform—and if the association does nothing more than to find out and classify the cases of bad lighting and bring them up to organizations or persons capable of dealing with them, it will still be doing a large work of humanity. The amount of ignorance among well-educated people regarding the fundamentals of ocular hygiene, particularly with respect to the use of artificial light, is almost unbelievable. If the agents or inspectors of the new association want to find startling examples of utter disregard of the basic principles of artificial lighting we would recommend them to the palaces of the rich rather than to the hovels of the poor. The latter may have only feeble and somewhat smelly kerosene lamps, but they are at least steady and generally shaded, while in the former one may find the most offensive incandescent lamps thrust out of more or less decorative but entirely unsuitable shades, or glaring through shades which seem to have been devised with special reference to giving a minimum of light with a maximum of glare. We sometimes think that the quality of fixtures for the purpose of their use is some sort of inverse function of their cost. At least it certainly seems as if the ornate and expensive fixtures had often been designed in contemptuous defiance of everything that has been taught the world regarding the proper use of light.

If one passes from dwellings and considers shops and factories, the conditions of illumination are perhaps changed rather for the better than the worse. The factories have the advantage of being freed from the monstrosities of bronze and crystal sometimes inflicted upon the householder, but they are in perpetual need of some missionary to preach the gospel of suitable lighting for the sake of the workman. Such a missionary force we trust the Association for the Conservation of Vision will send out. Bad industrial conditions when once recognized can very gen-

erally be remedied. The "efficiency engineer" is, or ought to be, thoroughly appreciative of the importance of good lighting in facilitating rapid and thorough work. Indeed, we fancy the greatest difficulty will be found in breaking the workman himself of some of the common and crude notions regarding lighting. Need of activity there assuredly is, and we hope that the new organization will serve as an efficient directive force in carrying on in systematic and widespread form the work which has already been inaugurated along many lines which need only to come to a common meeting point and to merge their efforts for a common purpose.

ORNAMENTAL STREET LIGHTING.

The report of the National Electric Light Association's committee on ornamental street lighting is an excellent summary of accomplishment. It sets forth, with brief comment, what has actually been done in the way of the more elaborate and spectacular efforts at street lighting, which have been numerous in the past few years. It is gratifying to record the steadily increasing interest that has been shown in improved street lighting. The public awakening to the needs of the modern city in this particular is most encouraging as showing the civic evolution which has been going on in many phases of public affairs. Plenty of energy has been displayed, sometimes, it is true, misdirected, but always auguring well for the standards of the community. The lighting classified by the committee as ornamental falls naturally into three groups, arc lighting, the festoon system of incandescent lighting and the more recent and more successful lighting by ornamental posts with groups of metallic-filament lamps.

As regards arc lighting, there is very little which should properly be classified as ornamental. The fixtures employed are rather better than has been common in this country, but neither the fixtures nor the illumination would strike a visiting foreigner familiar with street lighting in Continental cities as implying anything more than a workmanlike attempt to furnish adequate illumination in streets deserving it. He might regard it here and there as rather overdone from the standpoint of judicious expenditure, but never as implying a special effort at artistic effect or extraordinary municipal activity in providing street lighting. There are indeed very few arc installations in this country which should properly be classified as ornamental lighting save in isolated spots. Many of the installations cited by the committee were never intended to be anything more than first-class lighting installations suitable for the busy streets on which they are placed. The lighting, for example, in Syracuse, N. Y., or Baltimore, Md., is brilliant and well distributed, but no more elaborate than might reasonably be expected in the important streets where it is installed. The flame-arc lighting in Boston is purely utilitarian, being merely an example of thoroughly good lighting of public squares after methods already familiar on the Continent. We may, therefore, pass by the arc-lighting matter as simply embodying vigorous efforts in the right direction without in any sense entering the field of decorative lighting.

The street lighting with incandescent lamps now practised in perhaps a hundred American cities is of a more ambitious character, the decorative effect being always in mind and efficiency being in most cases obviously a secondary consideration. Some of the artistic results obtained are unquestionably admirable, while in other instances the effect is altogether garish and out of keeping with the environment. This latter criticism applies with particular force to much of the festoon lighting. A score of cities employ it in various forms. Considered as a method of street illumination it is neither successful nor economical. From a decorative standpoint it is better adapted for temporary than for permanent use, since there are very few places, and these only in a few important cities, where the environment justifies illumination of this particular kind. It should be installed only where the supporting structure can be made decorative by day as well as by night and in surroundings that make a festal aspect appropriate. Arches of iron pipe spanning a street of cheap and perhaps tawdry blocks may serve a useful purpose for some temporary civic celebration like the twenty-fifth anniversary of the granting of the city charter, but they are not harmonious or appropriate as permanent methods of street lighting, either decorative or utilitarian. We are glad to note that the festoon is tending to pass out of use and to be replaced by well-spaced lamps upon appropriate posts.

Groups of metallic-filament lamps on ornamental or at least inoffensive posts are in use in about eighty cities scattered widely all over the country. The usual installation is three to five lamps on the post according to design, with ratings varying from 40 watts to 100 watts, generally, we are glad to say, installed in diffusing globes. The usual spacing is from 50 ft. to 100 ft. apart, in rare instances less, in a few more. At the shorter spacings, say, 40 ft. to 60 ft., these clusters give an excellent illumination and the effect is upon the whole very pleasing. In a few instances arc lamps in diffusing globes have been installed in a similar way, and these, too, may, if spaced closely enough, be regarded as highly successful both from utilitarian and artistic standpoints. In the majority of cases the abutters, either as tenants or owners, have paid a large part of the installation and operating cost, sometimes the whole. In a number of instances the installation cost has been so paid and the city has assumed the cost of operation. The system has not been worked out to its ultimate form, and there is much still to be done regarding the design of suitable posts and the selection of proper sizes and number of units for obtaining the best results. Generally speaking, such installations would be improved by more posts and fewer units on each post, an arrangement which would somewhat increase the cost of installation but lower the operating expense. It is possible that both arc and the larger incandescent lamps can be made exceedingly useful in this particular type of lighting. It is never economical for the production of a brilliant effect as at present installed, but it is very suitable in many places, and from an artistic standpoint is certainly a great improvement on the creaking mast arms and sputtering arc lamps on street corners that have been too characteristic of American street lighting in the past.

Federal Suits Against Incandescent Lamp Companies.

It is reported that terms have been agreed upon by the United States Attorney-General and the incandescent lamp manufacturing companies indicted on March 3 at Cleveland, Ohio, for alleged violation of the Sherman anti-trust law. No confirmation of this report could be obtained from the Department of Justice in Washington nor from a legal representative in New York of the lamp companies. An official at the Department of Justice stated that during the past week there had been no new developments in the cases, which are under the direct charge of Mr. Wade H Ellis, representing the government.

According to the newspaper reports attorneys for the companies have submitted to Attorney-General Wickersham a decree which the companies are willing to have entered in settlement of the case, and it is stated that this, with some modifications, will be accepted by the government. The decree, it is further stated, is regarded by the Department of Justice as largely a formality, as the alleged combination began to dissolve after the government filed suit and was followed by the voluntary dissolution of sixteen other pools alleged to control prices and restrict competition of practically all modern electrical apparatus. Reports to Attorney-General Wickersham are to the effect that all trade restrictions have been removed, and that in the case of incandescent lamps prices have been reduced 33⅓ per cent, a total annual reduction of $7,000,000.

Westinghouse Annual Meeting.

The annual meeting held last week in Pittsburgh of the Westinghouse Electric & Manufacturing Company was the scene of a hotly fought contest for the control of the corporation between Mr. George Westinghouse and those who have had predominating influence in the management of the company the past several years. The result was a majority vote of the stockholders in favor of the latter element. At a meeting of the board of directors following the election Mr. Edwin H. Herr, first vice-president, was elected president of the company, succeeding Mr. Edwin F. Atkins, of Boston, who had requested to be relieved of the office, which he had accepted last year with the understanding that his incumbency would be temporary. Mr. Robert Mather, representing the controlling financial interests, remains chairman of the board of directors.

Mr. E. M. Herr, the new president, was born at Lancaster, Pa., May 3, 1860, and began his career as a telegraph messenger and then as an operator in Denver, Col., later becoming station master and operator at Deer Trail, on the Union Pacific Railway. While in this service he prepared for college and was graduated from the Sheffield Scientific School of Yale College in 1884. After graduation he became a special apprentice of the Chicago, Milwaukee & St. Paul Railway in the motive-power department at West Milwaukee, and later entered the motive power department of the Chicago, Burlington & Quincy Railroad as mechanical draftsman and test engineer. Owing to his former experience he was finally made superintendent of telegraphs of the C., B. & Q. system, and his work in this department, especially during the Burlington strike, brought him to the attention of the operating department and led to his appointment as division superintendent of the Galesburg Division of the line. In 1890 he went with the Chicago, Milwaukee & St. Paul Railroad as master mechanic, which position he held until 1892, when he was called to the superintendency of the Grant Locomotive Works at Chicago. In 1895 he was sent to Europe by financial interests to report upon and establish locomotive works in Russia, upon the completion of which mission he became, in 1896, general manager of the Gibbs Electric Company, of Milwaukee, and shortly after accepted the position of assistant superintendent of the motive power department of the Chicago & Northwestern Railroad. In 1897 he went to St. Paul as superintendent of the motive power department of the Northern Pacific Railroad, which position he retained until 1899, when he went to Pittsburgh to take the position of assistant general manager of the Westinghouse Air Brake Company, later becoming general manager of that company. In 1905 he was appointed first vice-president of the Westinghouse Electric & Manufacturing Company, which position he has occupied continuously up to the present, having had direct charge during this period of all manufacturing and commercial operations of the company. President Herr has appointed Mr. Calvert Townley as his assistant. Mr. H. P. Davis, of East Pittsburgh, who has been assistant to the first vice-president and manager of engineering, was elected to succeed Mr. Herr as vice-president.

Ohio Electric Light Association.

A telegraphic account of the first two days' sessions of the Ohio Electric Light Association at Cedar Point, on Lake Erie, was given in last week's issue of the *Electrical World*. The third session, that of Thursday morning, July 27, was opened by Secretary D. L. Gaskill with a report on the insurance rates charged electric-light companies in Ohio. The sixty-one stations reporting, it was shown, had paid out $16,411 in premiums during the period 1905 to 1909, and in this time collected $60 damages. This single indemnity was due to a tramp's setting fire to a packing box which burned up a couple of window frames. Large profits for the underwriters were similarly revealed from the liability insurance returns. Secretary Gaskill advised that the subject of mutual insurance among themselves be investigated by the electric-light companies, and the subject was discussed further by Messrs. C. W. Townsend, of East Liverpool; J. C. Martin, of Wilmington; E. A. Bechstein, of Sandusky, and C. V. Hard, of Wooster.

The subject of pumping water for municipalities and for irrigation was next discussed in a paper by Mr. B. H. Gardner, of Dayton. Mr. Gardner referred to the off-peak, long-hour nature of the pumping load, and cited the extent to which electric pumping is done by the Northern Colorado Power Company, as reported by the *Electrical World*, which he quoted. The author pointed out the value of irrigation even for ordinarily humid ground, and gave cost figures for flowing water onto the surface. The paper was discussed by Messrs. R. S. Graves, of Schenectady, N. Y.; C. C. Smith, B. H. Gardner, C. W. Townsend, J. C. Martin, C. H. Culver, J. T. Kermode, W. C. Anderson, D. L. Gaskill and J. A. Stewart.

Mr. John Gilmartin, chairman of the meter committee, then submitted his report, which considered under separate topics the importance of meter testing, proper intervals therefor, tabulation of results, definitions, accuracy data, jewels, excess indicators, etc. The report supplemented the exhibit made by the committee, which included a number of different types of meters arranged for testing and also a collection of the various record and office forms used by companies in the State. The discussion of the report was opened by Mr. W. L. Cook, of Columbus, who cited a number of objections to the testing of meters on customers' premises, and was continued by Mr. R. S. Graves and Mr. G. R. Smith, of the New York Edison Company.

A review of the new utility law of Ohio in its application to electric-lighting companies was next presented by Secretary Gaskill, who is president of the Greenville (Ohio) Electric Lighting & Power Company. The shortcomings of the bill as enacted were pointed out, a serious omission being the lack of any provision for protecting

going concerns against competing utility companies. The present utility law was thus characterized as of little benefit to the people it should serve and was declared to have been originated largely for political purposes. The subject of the new law was then discussed warmly in executive session.

Vice-president Anderson in the chair opened Friday's session with the reading of his paper on "Motor-Driven Refrigeration." Consumption figures from a number of installations were cited, showing the advantageous annual load-factor of the motor-driven compressor outfit. The subject was discussed briefly by Messrs. W. S. Culver, J. C. Martin, C. I. Crippen, W. S. Townsend and Mr. Taylor, of Norwalk.

"The Use of Tungsten Lamps in Sign and Outdoor Lighting" was the subject of a paper by Mr. W. B. Goudey, of East Liverpool, Ohio. After noting the improvement of tungsten lamps over carbon-filament lamps the author reported difficulties experienced in burning sign lamps in series. Messrs. G. H. Stickney, W. Benedict, C. I. Crippen, J. T. Kermode and O. B. Reemelin also discussed series connection of sign lamps.

A paper by Mr. P. L. Miles, of Cleveland, on "Progress of Electric Heating Devices in Ohio," was next read by Secretary Gaskill in the author's absence. Campaigns in a number of Ohio cities were reported, the general tendencies of the electric heating art were reviewed, and the Cleveland continuously connected cookstoves (described in the *Electrical World*) were explained and illustrated.

The report of the nominating committee, presented by Chairman S. M. Rust, was unanimously adopted, officers and committees being elected as follows:

President, Mr. W. C. Anderson, Canton; vice-president, Mr. J. C. Martin, Wilmington; secretary, Mr. D. L. Gaskill, Greenville.

President-Elect W. C. Anderson.

Executive Committee—Messrs. E. H. Beil, W. S. Townsend, W. E. Richard, O. H. Hutchings and L. G. White.

Advisory Committee—Messrs. Samuel Scovil, F. M. Tait and D. L. Gaskill.

Finance—Messrs. J. T. Kermode, F. O. Plymole and B. H. Gardner.

Publicity—Messrs. W. P. Engle, C. M. Lott, Elam Fisher and Robert N. Hodson.

Electric Transmission—Messrs. W. S. Townsend, J. T. Kermode and M. H. Wagner.

Membership—Messrs. W. J. Hanley, E. Van Winkle, F. C. Colwell, George Vail, W. A. Benedict, P. J. Williams and N. C. Catabish.

Meters—Messrs. John Gilmartin, H. Cook and J. T. Kermode.

Insurance—Messrs. D. L. Gaskill, J. C. Martin and C. V. Hard.

Motor Applications—Messrs. E. A. Bechstein, C. I. Crippen and W. F. Hubard.

Committee on Costs—M. E. Turner, B. H. Gardner and J. D. Lyons.

ENTERTAINMENT.

Thursday afternoon a baseball team composed of central-station men lined up against a picked nine of associate members and beat them, 9 to 5, winning a handsome silver cup donated as a trophy by the Duncan Electric Manufacturing Company, of Lafayette, Ind. The personnel of the teams was as follows:

Active Members.	Positions.	Associates.
D. A. Gaskill	First Baseman	Bischoff
Cook	Second Baseman	G. R. Smith
C. C. Smith	Shortstop	Wider
Ruff	Third Baseman	Graves
Kermode	Left Fielder	Mueller
Engle	Center Fielder	Strasburg
Sloan	Right Fielder	Reynolds
Barnard	Catcher	Parke
Gardner	Pitcher	Howland

The ladies were meanwhile entertained at a musicale and card party, and in the evening there was another informal dinner for all as guests of the association, followed by a creditable special vaudeville entertainment.

The total registration at the Ohio convention reached nearly 400, including the central-station men (many of whom brought their families), associate members, manufacturers, etc. Although the Ohio association is one of the largest of the state organizations, its convention was made notable by the liberality of entertainment accorded to all who came. There was a completely appointed informal dinner or banquet each evening, followed by music, magic and vaudeville. Each lady attending the banquet was presented with flowers, and hand-painted china plaques were provided for members' families. Handsome prizes were awarded at the ladies' card parties. The cost of holding the convention at Cedar Point this year, reaching nearly $2,500, is met from the association treasury. The resort on Lake Erie in itself proved an equally ideal convention spot for recreation during off hours, with its big hotel and dining-rooms, splendid bathing beach, amusement park, natural woods, lagoons, etc.

The Beloit Rate Case.

Very thorough preparation was made of the "Beloit case" presented to the Wisconsin Railroad Commission by the city of Beloit on March 30, 1908, and decided July 19, 1911. The city asked for a full investigation of the rates of the Beloit Water, Gas & Electric Company, and in the issue of last week, page 262, was given a summary of the decision as it affected the rates for electricity. Changes were also made by the commission in the gas and water rates. A rather formidable group of experts was retained on each side. The city spent between $10,000 and $11,000 in the presentation of its side of the case, while the company expended about $30,000 on its defense. Legally the city's case was placed in charge of Mr. H. W. Adams, city attorney, and Mr. Thomas S. Nolan, of the firm of Nolan, Adams & Reeder, of Beloit and Janesville, Wis. The city then engaged Mr. Frank F. Fowle, of Chicago, as electrical expert and general technical adviser. Likewise the services of the following-named gentlemen were secured: Mr. C. H. Evans, of Chicago, as gas expert; Mr. G. W. Sturtevant, of Chicago, as water-works expert, and Mr. W. H. Wheeler, of Chicago and formerly of Beloit, an experienced water-works contractor and one of the early officers of the Beloit Water Works Company. The city also retained the services of Prof. E. T. Smith, of Beloit College, and Professor Russell, dean of the School of Agriculture at the University of Wisconsin, who testified in relation to water supplies.

The electrical expert for the company was Mr. L. G. Van Ness, of Memphis, Tenn.; the company's gas expert was Mr. A. E. Forstall, of New York City; its experts on water-works and water-power were Prof. D. W. Mead, of

the University of Wisconsin, and Mr. Benezette Williams, of Chicago. Considerable testimony was also introduced by Mr. C. B. Salmon, president, and Mr. B. F. Lyons, assistant general manager, for the company.

Both the city and the company carried on elaborate investigations and prepared separate inventories and appraisals. For the city Mr. Fowle prepared an exhaustive report of nearly 300 pages dealing with valuations, capitalization, operation and operating efficiency, examination of books and accounts, statistics of production and sales, water-power, going value, depreciation and rates. The other experts for the city prepared appraisals of the physical property. These reports were all introduced at the hearings as evidence for the city. Under the direction of its experts the company prepared an inventory and appraisal, which was substantiated by the testimony of the company's experts at the hearings.

Commission of Subway Engineers for Chicago.

Authorized by the local transportation committee of the City Council to appoint three engineers to recommend a system of passenger subways for Chicago, Mayor Harrison has acted on the suggestion promptly and has named on this commission Mr. John Ericson, city engineer; Mr. E. C. Shankland, designing engineer, and Mr. James J. Reynolds, operating engineer. Mr. Ericson, who has paid much attention to the subway problem, is appointed especially for his practical knowledge of underground utilities in Chicago. Mr. Shankland is a well-known authority on Chicago building foundations and subsoil conditions. Mr. Reynolds, who is a railroad man, is appointed as an engineer especially familiar with transportation questions.

Mr. Bion J. Arnold, who was the city's chief subway engineer during the last administration, is not appointed on this commission. It is said that Mayor Harrison does not favor the double-deck subway or a subway extending from building line to building line. utilizing the space under the sidewalks, as suggested by Mr. Arnold. The present Mayor is said to be desirous of seeing the subway built or at least begun during his administration, and is reported to favor a modest beginning of a system of relief for traffic congestion in the central business streets. The recently appointed subway advisory engineers will receive annual salaries of $12,000, an allowance being made to the city engineer to bring his present salary of $8,000 up to that amount during his service on the subway board.

Fire Drills Adopted by New York Edison Companies.

The Edison Electric Illuminating Company of Brooklyn and the New York Edison Company have made contracts with the Croker National Fire Prevention Engineering Company, founded a short time ago by Mr. Edward F. Croker, ex-chief of the New York Fire Department, for supervision and instruction in fire drills. The inspectors of the company will act with ex-Chief Croker in the fire department and make it their business to see that employees are efficiently drilled in the proper methods of leaving a building in an orderly manner in the event of fire and that the fire appliances are thoroughly cared for and kept in proper condition, also instructing employees in the use of these appliances. Thorough inspection of buildings, exits, etc., is also part of their work. In buildings containing a large number of employees the inspectors arrange these in several fire divisions under a leader and designate the stairways to be used by each division. As a result of long experience with fires the inspectors of the Croker company prohibit the use of elevators in emergency. The first inspection of the Duane Street building of the New York Edison Company was made July 14, and the first drill was held July 19. At the Duane Street building of the New York Edison Company employees on each floor were divided into three sections, and an explanation was given of what was to be done when fire signals were given. The inspectors made it clear that the success of the work depends upon cool, prompt and orderly procedure. The first duty of each employee was quickly to place in safety as much of the valuable property in his charge as possible, this applying more particularly to the bookkeeping department, which has metal desks. At the recent drill signals were given on each floor separately, and instructions were carried out to the satisfaction of the inspectors. The bookkeeping department was vacated in twenty seconds.

Massachusetts Commission News.

An important decision on the petition of the Selectmen of the town of Plymouth, Mass., complaining of the price of electricity for street lighting supplied by the Plymouth Electric Light Company was rendered by the Massachusetts Gas and Electric Light Commission on July 28.

Prior to August, 1907, the company was supplying for street lighting about 339 incandescent carbon-filament lamps and eight arc lamps rated at "1200 cp." Three of the incandescent lamps were of 32-cp and the others of 25-cp rating, and all operated on a midnight-moonlight schedule. In that month the company began the replacement of these incandescent lamps with 40-cp tungsten-filament lamps. Later the arc lamps were replaced by clusters of five 40-cp and a few 200-cp tungsten incandescent lamps were installed. All the arc and carbon-filament lamps have thus been replaced by incandescent lamps.

Before and since the above changes the company charged the town $21 a year for the 32-cp, $20 for the 25-cp incandescent and $125 a year for the all-night arc lamps and $85 a year each for those operating until midnight. Prior to the town meeting, 1909, the company offered to supply, on a five-year contract, on moonlight schedule the incandescent lamps until 12 midnight at $18 a year and for all night at $21 a year, with a uniform price of $105 per year for the arc lamps, all the incandescent lamps to be 40-cp tungsten units. No action was taken until a year later, when the town authorized its Selectmen to make a five-year contract on such terms as they should deem proper, but also instructed them to enter a complaint to the Board of Gas and Electric Light Commissioners as to the quality and price of service furnished by the company.

The lamps in present use are 336 40-cp, 50-watt tungsten, three 250-watt tungsten and eight clusters of five 40-cp lamps each. All operate on a moonlight schedule until midnight, except seven of the clusters, which operate all night. The lamps, however, are billed to the town in the same way as in August, 1907, that is, bills are made for 336 25-cp lamps at $20, three 32-cp at $21, seven arc lamps at $125 and one arc lamp at $85 a year.

In August, 1907, the price of energy for commercial lighting was 20 cents a kw-hour, with discounts of 5 per cent and upward according to size of the bill. Prior to the petition these prices had been reduced to a minimum rate of 18 cents, with a sliding scale to 10 cents, according to the amount used monthly, and a discount of from 10 per cent to 20 per cent according to the number of nights' use each week.

Under the scale of prices for commercial lighting the company received during the fiscal year of July 1, 1909-June 30, 1910, for all electricity sold for this purpose only a little more than 8 cents per kw-hour. The complaint originally framed related to commercial prices as well as those for public street lighting, but this part of the petition was finally waived by the Selectmen. It was contended in

support of the claim that the price charged for incandescent lamps is too high; that, irrespective of prices charged in other cities of the State for 25-cp carbon-filament lamps, the price for tungsten lamps now in use should be less because the latter, though of higher candle-power, consume less energy than the former, and that compared with prices charged by the company to its other consumers the price for street lighting is too high.

It was contended that the price for street lighting should be based on a theoretical consumption of energy by the lamp either at the average rate charged for commercial lighting or at the average for all lighting, commercial and public, or upon the same schedule as commercial lighting, all the street lamps being regarded as the installation of a single commercial customer with an annual bill.

The company contended that the candle-power is the true measure of the value of the street lighting to the town and a proper basis for the price. The commissioners' decision states that while price charged for street lighting in other communities is not without weight, it cannot be held to be controlling. Such comparisons, it says, must usually be made with prices charged for carbon-filament lamps, and that until very recently in fixing prices for street lighting no consistent theory has been followed either by the companies or by the public authorities, save a purpose on both sides to make the best trade possible.

"It must be conceded," the commissioners say, "that based upon cost alone the street lamps of the tungsten type and of the same or even of a somewhat higher candle-power can be supplied at a less price than the carbon-filament lamp until recently exclusively used because of their lower cost to maintain and operate, but it is by no means clear that such reduction in cost is proportional to the difference in the amount of energy consumed in the lamp. Neither those investment, distribution and management costs which necessarily enter into and constitute a substantial share of the total nor, for that matter, certain of the costs of producing the electricity seem to be in any degree reduced by the substitution of tungsten for carbon-filament lamps. Coal, and possibly repairs and maintenance, with some minor supplies at the station, appear to be the only items of street-lighting cost of which it may safely be claimed that they vary according to the quantities of energy made and used. The actual saving to the company in these items, due to the less amount of energy required for the tungsten as compared with the carbon street lamps in Plymouth, based upon the figures of the fiscal year ended June 30, 1910, appear to be somewhat less than $1 a year for each lamp, although the reduction in energy used in the lamp is more than 40 per cent. Indeed, the tendency of the introduction of tungsten lamps is to increase the cost per unit because of the reduction in the total units sold without any reduction in costs outside the generating station—a tendency which obviously can be overcome to a large extent by the general development of the business and by other factors of importance.

"However, unless the prices charged or offered for carbon-filament lamps are assumed to be reasonable, the inquiry as to the amount of reduction justified by the substitution of tungsten lamps offers no real solution of the problem as to what price the town should in fairness pay.

"The proposition that the price of street lamps should be based strictly on the amount of energy required to operate the lamps and should be made upon the same or as advantageous terms as are offered to private consumers is more fundamental. Just why any more weight should be given to the suggestion of an average price received rather than any other price in the company's varied schedule was not fully explained. The average price which is determined by dividing the total receipts from all customers by the total kw-hours sold is not, unless by chance merely, the price offered to any customer. It may be that no customer ever pays exactly that price, and it is difficult to see why, if the street lamps are to be governed by the commercial schedule, that price rather than some other of the numerous prices which it contains should be adopted. That it is a very attractive proposition to the town is evident because it would result in an exceptionally low price for the street lamps, the average price received by the Plymouth company for commercial lighting being lower than in most companies of its size in the State. It is important also as a general proposition, because if applicable to Plymouth it is difficult to see why it might not be applicable to all other communities.

"The board is unable to agree with the contention that the energy used in all of the lamps should be combined and treated as the energy supplied to a single consumer; in other words, that all the lamps should be taken together and considered as a single installation to a large consumer. It is quite true that the billing and collection costs are minimized under the conditions of street-lighting supply and become those of a single customer, but the numerous and widely scattered installations and the investment and maintenance charges give to each lamp or group of lamps many of the characteristics of an individual customer of small size if the commercial scale of charging is to be applied."

The commission states that companies should more fully recognize the reasonableness of the claim that towns and cities should fare as well for public as for private lighting. "Street lighting," it says, "should bear its reasonable proportion of all necessary costs, but its fair price is not necessarily determined upon the commercial rates, especially if these happen to be unreasonably high or low." Its decision goes on to say that the methods used to determine public and private lighting prices must be directed to a single end—to determine what is a fair price under all the circumstances of the case.

The commission says that the company's burden of debt justifies it in an endeavor to eliminate in a reasonable time that part of its indebtedness which represents the depreciation of the plant for which provision has not been made hitherto. Under the existing circumstances the board considers the following rates fair, and recommends as follows:

That on and after Aug. 1, 1911, the prices for moonlight lighting substantially as heretofore shall not exceed the following: For 50-watt, 40-cp tungsten lamps operating until midnight, $16 a year; for 50-watt, 40-cp tungsten lamps operating all night, $20 a year; for 250-watt, 200-cp tungsten lamps or equivalent in clusters of five 50-watt, 40-cp lamps operating until midnight, $71 a year; for 250-watt, 200-cp tungsten lamps or equivalent in clusters of five 50-watt, 40-cp lamps operating all night, $89 a year.

New York Commission News.

A complaint has been received by the Public Service Commission, Second District, from the Board of Supervisors of the County of Orleans and the board of trustees of the village of Albion protesting against the increase in rates by the New York Telephone Company in Albion and vicinity. The complaints state that the company has raised the telephone rental for business places from $2 to $2.50 per month and for residences from $1 to $1.25 per month, and that the service furnished is unsatisfactory and does not warrant the increase in rates.

The commission this week will hear the petition of the Hartwick Power Company for permission to exercise a franchise for the furnishing of electricity in the town of Hartwick, Otsego County, and the application of the Wynantskill Hydroelectric Company for permission to exercise franchises in the villages of Sandy Lake and North Greenbush, Rensselaer County, and for authority to issue stock to secure funds for the construction of its plant.

After a controversy extending over a period of nearly seven years the application of the Long Acre Electric Light & Power Company to issue additional bonds for raising funds for the erection of a lighting plant was granted on July 28 by the Public Service Commission for the First District of New York. Permission was given to the company to make a new mortgage for $50,000,000, under which $2,000,000 of bonds may be sold when $1,000,000 of new stock has been subscribed and paid for. The order of the commission provides that an additional $2,000,000 of bonds may be disposed of when another issue of $1,000,000 stock has been absorbed, and further issuance will be allowed in this ratio. A prior mortgage authorizing $1,000,000 bonds must be either canceled or subordinated to the new mortgage before the latter can be made, and the $400,000 bonds authorized under the prior mortgage and $100,000 additional bonds under this mortgage, held by various interests as collateral, must be canceled before the new securities can be issued. The application of the Long Acre company was at first denied by the commission on the ground that the necessity for an additional lighting company in the districts named in the franchise of the company was not proved. The case was then taken to the Appellate Division of the Supreme Court, the decision of the commission was reversed and a rehearing was ordered. At subsequent hearings much opposition was made by attorneys of the New York Edison Company against the rights claimed by the Long Acre company to operate under its franchise. In the issue of June 1 announcement was made that the Public Service Commission would proceed to consider the amount of securities that the company would be permitted to issue and the terms under which the securities would be approved.

Mr. Ralph W. Pope.

At the Chicago convention of the American Institute of Electrical Engineers a committee consisting of Messrs. John J. Carty, chairman, George A. Hamilton and D. B. Rushmore was appointed to prepare for presentation to the board of directors resolutions expressing the appreciation felt for the services of Mr. Ralph W. Pope, who had tendered at Chicago his resignation as secretary of the Institute, and later was appointed honorary secretary without reduction in salary. The report of the committee is as follows:

"For more than twenty-six years Mr. Ralph Wainwright Pope has faithfully and loyally served the American Institute of Electrical Engineers as secretary, and for the twenty-seventh consecutive year he has again been elected to the office of secretary. The board of directors and the membership at large are of the opinion that by his continuous and honorable service he has attained such a position in the regard and affections of the members of the Institute that he is entitled to some relief from the active executive duties of his arduous position. Therefore, to carry out his own expressed wish his resignation as secretary has been accepted. In accepting his resignation the board of directors in order to give expression to its own feeling of gratitude as well as the feeling of the membership at large, and in order to reward such long and distinguished service, has appointed him to the position of honorary secretary, in which capacity the Institute may still have the benefit of his long experience in its affairs.

"In thus complying with the natural and just desire of Mr. Pope, the board of directors has thought it well to mark this change by this minute expressing its good will and appreciation, and by pointing out that the term of Mr. Pope's service in the Institute covers many of the most important developments in electrical engineering, and that this period has witnessed the growth of the Institute from the humblest beginning to its present flourishing condition.

"At the time when the art of electrical engineering was practised principally in connection with the telegraph Mr. Pope was a pioneer, having in the year 1858 mastered the working of the Hughes printing telegraph. In 1861 he had charge of the Morse telegraph office at Great Barrington, Mass., in which town he was born in 1844. In 1862 and 1863 he was in the service of the American Telegraph Company in its New York, New Haven and Providence offices, and in 1865 he was one of that band of telegraph pioneers who went into the wilds of British Columbia to establish an overland telegraph system with Europe by means of Alaska and Siberia. In 1867 he was with the Bankers & Brokers' Telegraph Company until 1872, when he became an inspector with the Gold & Stock Telegraph Company. While with this company he was promoted to the position of deputy superintendent in 1880, at which time the apparatus used by the Gold & Stock Telegraph Company was considered by many as representing the highest development then reached by the electromechanical art. While in the service of the Bankers & Brokers' Telegraph Company in 1867 he was also assistant editor of *The Telegrapher*. In 1882 he became manager of the Union Electric Manufacturing Company, of New York. In 1884 he was associate editor of *The Electrician and Electrical Engineer*. In that same year the American Institute of Electrical Engineers was formed. The next year Mr. Pope was elected its secretary, which position he is about to relinquish. In 1890 he founded the monthly periodical *Electric Power*, and in 1891 he became editor for electrical terms in the 'Standard Dictionary.' In 1893 under direction of council his quarters as secretary were established in the rooms of the American Institute of Electrical Engineers in the Electrical Building at the Columbian Exposition, and he was appointed on the committee of judges for the Department of Electricity. While at the exposition in Chicago he personally met more than two-thirds of the members of the Institute at that time. Ever since Mr. Pope has kept up his large personal acquaintance among the members, which is of great importance to a headquarters official.

"During the administration of President Stillwell Mr. Pope visited a majority of the sections and many of the branches of the Institute and made a study of their development and needs. All of these activities have eminently prepared him for the position of honorary secretary, giving special attention to the organization and the interest of the sections and branches."

CURRENT NEWS AND NOTES.

Electric Club of Chicago.—At the last meeting of the Electric Club of Chicago it was decided to hold no further meetings until Sept. 13. The club also voted not to give a picnic this year.

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Electrical Banquet in Winnipeg.—The city light and power department of Winnipeg, Manitoba, of which Mr. James G. Rossman is general manager, gave an electrically prepared banquet to the Mayor and members of the City Council of the city in the "Home, Sweet Home," exhibit at the Canadian Industrial Exhibition on July 22. The dinner consisted of soup, fish, chicken, vegetables and coffee, besides many dishes that did not require heat, as fruit and salad. It was cooked on a large "navy range" secured through the courtesy of the Canadian General Electric Company from the Chicago office of the General Electric Company. This range weighs about 2000 lb. and was equal to the occasion in every respect. The table was set for a party of about twenty, and the electrical preparation of the food was carried out, as planned, without a hitch.

GIFT TO MCGILL UNIVERSITY.—Sir William Macdonald has presented to McGill University a large tract of land adjoining Mountroyal Park, which will be used as a campus and for residence plots. The purchase price was over $1,000,000.

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HEATING VALUE OF FUEL OIL.—In consequence of the success that has attended the use of heating value specifications in buying and selling coal, the Bureau of Mines, Washington, D. C., has drawn up similar specifications for the purchase of fuel oil. These are contained in technical paper No. 3 issued by the bureau.

* * *

A NOVEL HYDROELECTRIC TAXATION CASE.—The right to tax ground forming a made channel for a stream of water used for power purposes is to be tested at South Bend, Ind. The stream is 720 ft. long and 40 ft. wide, running through that city, and has never been assessed for taxation. The South Bend Hydraulic Company is resisting the attempt on the part of the tax board to list the property for taxation.

* * *

GARAGE TRANSFORMED FOR ELECTRIC SERVICE EXCLUSIVELY.—The People's Garage, of 339 East Garfield Boulevard, Chicago, is equipping its present automobile station, which is 130 ft. long and 60 ft. wide, for the exclusive service of electric cars. Two motor-generating charging sets will be installed, one rated at 50 kw and one at 25 kw. Electrical energy is purchased from the Commonwealth Edison Company. A new building for the gasoline garage will be erected on a nearby location.

* * *

SONS OF JOVE AT CEDAR POINT, OHIO.—At the rejuvenation of the Sons of Jove, held the evening of July 26, during the convention of the Ohio Electric Light Association at Cedar Point, Ohio, a class of thirty-four candidates was initiated into the mysteries of the order. Messrs. R. L. Janes, of Pittsburgh, statesman for Pennsylvania, and A. C. Beattie, of Cincinnati, Ninth Mars, presided at the ceremonies, the work of which was in charge of National Secretary E. D. Strickland, of Chicago.

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COUNTING TELEPHONES.—City Electrician Carroll, of Chicago, is engaged in the task of counting the subscribers of the Illinois Tunnel Company, the receivers of which are operating, or are beginning to operate, a competing automatic telephone system in Chicago. Mr. Carroll's task is to determine whether the automatic company had 20,000 bona fide subscribers on June 1 last. The list of subscribers offered by the company is first checked up and then each one listed is called up on the automatic telephone.

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ELECTRIC TRUCKS FOR NAVY YARDS.—The United States Navy Department has bought twelve electric trucks for the use of the Bureau of Yards and Docks. Eight of these are 5000-lb. trucks, the other four being standard 5-ton trucks, and all are equipped with lead batteries. The distribution will be as follows: To the Boston Navy Yard, one 5000-lb. truck; to the Portsmouth (N. H.) Navy Yard, one 5-ton truck; to the New York, Norfolk and Mare Island navy yards, one of each size; to the Philadelphia, Charleston and Puget Sound yards and Public Works Officer, island of Guam, one each of the 5000-lb. size.

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POWER-HOUSE DAM SAID TO CAUSE MOSQUITOES.—Residents of the village of River Forest, a suburb of Chicago, are said to hold the North Shore Electric Company largely responsible for a plague of mosquitoes that has afflicted the village this summer. Not long ago the company built a higher dam in the Desplaines River in connection with its generating station at Maywood, and this dam, by covering lowlands with stagnant water, is held to be the cause of the abnormal number of mosquitoes by providing breeding places. The village trustees have asked the company to remove the dam.

* * *

AUTOMATIC TELEPHONES FOR ENGLAND.—The British post office will install two experimental automatic telephone exchanges, one at Epsom on the Strowger system, and the other at Caterham on the Lorimer system. Each will be equipped for 500 stations. An automatic system for 400 stations will also be installed at the post office headquarters in London, this exchange to serve the official departments. The Lorimer differs from the Strowger system in that the exchange mechanism is in continuous motion whether calls are being made or not, while in the Strowger system no movement is made until a subscriber calls.

* * *

ENGINEERING EDUCATION IN GREAT BRITAIN.—The British Institution of Civil Engineers, which in recent years has several times given considerable attention to the subject of engineering education, recently held a conference on that subjct in which leading engineers and educators of Great Britain took part, the electrical industry and profession being well represented. A large number of papers were presented and discussed, and the result of the conference was embodied in a short resolution, the principal feature of which is renewed indorsement of the time-honored British "sandwich" system of alternate training at school and in the workshop, the specific recommendation being six months alternately in each. There was a preponderance of opinion that British engineers do not have sufficient training in English and along general cultural lines, and the hostility of the old-time British engineer and manufacturer to what they consider highly scientific instruction frequently cropped out. The German and American systems of engineering education, judging from absence of reference to them, are apparently not considered applicable to British conditions.

* * *

PROPOSED GAS RATES IN CHICAGO ATTACKED IN THE COURTS.—Following the adoption by the City Council of Chicago of an ordinance fixing the rates for gas, for a five-year period, at 75 cents for the first year, 70 cents for the second and third years, and 68 cents for the fourth and fifth years, the People's Gas Light & Coke Company has begun suit in the Circuit Court of Cook County to set aside these rates as unjust and unreasonable. The present rate is 85 cents and the company contends that the new rate of 70.2 cents, which is the average for the five-year period, is due to politics and not to a fair and disinterested study of the situation. The petition to the court points out that the report of Mr. W. J. Hagenah, the expert first employed by the city, who recommended a rate of 77 cents, was ignored by the committee of the City Council which took charge of the matter when the city administration elected on the "70-cent gas" issue came into office. Thereafter Mr. Edward W. Bemis was employed by the committee as an expert. The company charges that Mr. Bemis is neither an engineer nor an accountant and has no knowledge of the cost of manufacturing and distributing gas, except such as he may have gathered from reading the published reports of gas companies or the testimony in other rate-regulating investigations. The misstatements made by Mr. Bemis in his report are said to be grotesque. The company contends that it must be allowed a 7 per cent dividend rate, and it is asserted that if the rate of 75 cents had been in force during the last three years the company could not have paid 5 per cent dividends on its stock. It is assumed that the court will refer the petition to a master in chancery to investigate and report.

Los Angeles Telephone Rates.—The City Council of Los Angeles has failed to adopt the new schedule of telephone rates recommended by the Board of Public Utilities on the report of Mr. K. B. Miller, retained as an expert. This schedule increased the existing rates somewhat. The Council has voted that the old rates shall prevail. There are two telephone companies in Los Angeles, and the rates of the Home company are a little lower than those of the Bell company. Mr. Miller proposed to equalize the rates. The companies may ask the courts to compel the city to adopt the increased rates.

* * *

Work Started on New York's New Subways.—On Monday last, July 31, ground was broken by Chairman Willcox, of the Public Service Commission for the First District of New York, for the new tri-borough subway system. The ceremonies were held at Sixty-seventh Street and Lexington Avenue, and speeches were made by a number of city officials and Mr. Frank Bradley, president of the Bradley Contracting Company, which has the contract for a number of sections of the new system. The first spadeful of earth was removed by Commissioner Willcox with a silver shovel and placed in a receptacle for preservation by the Bradley company, and the second spadeful of earth was reserved in a similar way for the Public Service Commission.

* * *

A New Complaint Against the Gasoline Automobile.—An Iowa reader of *Telephony*, speaking as a telephone manager, presents a new indictment against the excesses to which the use of the gasoline automobile seems to lead many persons. A large number of telephone subscribers have automobiles, and it is asserted that some of them take the batteries off the telephones and use them on the automobile for the sparking outfit, replacing them with inferior cells at the telephone. Complaint is then made to the telephone company that the telephone is out of order and the company is compelled to send a man to replace the defective cells of battery with new ones. This operation consumes needless time and money and makes an unfair complaint of poor service, and the telephone manager is righteously indignant.

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Industrial Demand for Electricity in Southern California.—Southern California is not considered a manufacturing community, and yet Mr. John B. Miller, the president of the extensive Southern California Edison Company, says that more electrical energy is sold by that company for motor operation than for lighting. Since 1904 the power business of the company has been gaining on the lighting business, and in May, 1911, the revenue from energy sold for motors exceeded that for lighting for the first time in the history of the company. Electric pumping for irrigation accounts for a large percentage of the output, while the electrical operation of oil wells and refineries has lately become a conspicuous factor in the demand. Until recently the manufacture of cement was the leading industry in the consumption of electrical energy.

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Irrigation and Hydroelectric Projects in Spain.—To improve the conditions in the agricultural districts of Spain, plans have recently been accepted and the preliminary work has been begun on a large irrigation project. The main canal, which will probably be completed in about six years, will have a length of over 50 miles and the total length of main artery and branches will exceed 150 miles. This work is only part of a plan which calls for the irrigation of an area of about 300 sq. miles on the left bank of the Guadalquivir River, whose waters, at Palma del Rio, will be utilized. For additional water supply when the river water fails six reservoirs with a combined capacity of 68,684,000,000 gal. of water are planned for neighboring valleys. At present, however, only one of these reservoirs is to be built, having a capacity of 21,661,000,000 gal. A project for utilizing this tremendous water-power by the installation of electric power stations along the canal has been laid aside for the present unless some responsible syndicate acquires the rights.

* * *

Mexican Guayule-Rubber Industry.—The guayule-rubber industry is being seriously hampered and damaged by labor and political troubles that are now more general and of greater seriousness than during the period when the recent revolution was actually in progress. The factory of the Intercontinental Rubber Company at Torreon is closed on account of a strike of several hundred employees. The men demand an increase of wages which the company does not feel justified in giving. None of the men receive less than $1 Mexican money (49.2 cents gold) per day, while the ruling wages in other factories range from 50 cents to 75 cents, Mexican. It is announced that unless an early settlement of the strike is reached the factory will be kept closed until Jan. 1, 1912, or longer. Mr. E. Delafond, a Frenchman, who owns several guayule-rubber factories in the States of Coahuila, Zacatecas and San Luis Potosi, recently made a trip of inspection of his property. His factories suffered much damage at the hands of rebel bands. Mr. Delafond was at his factory in a remote part of the State of San Luis Potosi when it was attacked by rebels, who first demanded of him the payment of $6,000. When he refused to comply with their demands they tore down the French and American flags that floated from the buildings and then attempted to destroy the plant. Mr. Delafond made his escape in an automobile and reached the nearest railroad station, 60 miles away, without further adventure. Owing to the present unsettled condition of the guayule-rubber industry the output of crude rubber for the latter half of the present year will be very small.

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Brains, Labor and Capital.—During the recent Chicago convention of the American Institute of Electrical Engineers Mr. H. M. Byllesby gave a dinner at the Chicago Club to about sixty gentlemen to enable some of the prominent engineers to meet a few of the leading financiers of Chicago. In introducing the speakers of the evening the host gave the keynote of the occasion by referring to existing conditions of industrial unrest and expressing the hope that by a sincere effort to solve the problems of modern civilization a condition characterized by greater tranquillity and greater humanity will be evolved. In concluding his speech Mr. Byllesby said: "I believe it has become the duty of every serious-minded man, no matter in what calling in life, no matter in what walk of life his activities may find themselves, seriously to consider the present condition and to do everything that in him lies toward a fair and just and wise solution of the problems of the times. By doing this we can hope to better the conditions which surround our civilization. If we fail to make the effort, we shall have no one to blame but ourselves if in the undirected trend of passion resulting from ignorance or injustice, misapprehension or selfishness, our country drifts to the cataclysm of an economic or social revolution. We can view this situation as we please; we can adopt the doctrine of *laissez faire;* we can adopt the selfish doctrine of each man looking after his immediate interests; or we can adopt the far manlier and more worthy course of recognizing these problems and difficulties of the times and by drawing closer together the three great moving forces of modern life—labor, brains and capital—endeavor to direct thought and legislation and to bring about a condition more worthy of the great opportunities possessed by civilized humanity to-day."

MAIN SUBSTATION OF THE METROPOLITAN ELECTRIC COMPANY AT READING, PA.

Problems Involved in Converting an Old Generating Station into a Substation Without Interfering with Service.

THE combined lighting and railway equipment of the Metropolitan Electric Company, of Reading, Pa., one of the underlying companies of the Interstate Railways Company, was described in a general way in connection with the illustrated description of its new generating station which appeared in these columns on Nov. 17, 1910. At that time the distribution system was also given attention; but the substation was merely mentioned as a part of the whole. The substation has just been completed and, on account of the problems involved in its construction, its size, and the variety of its distribution, a more extended account of it is here given.

ORIGINAL USE AS A GENERATING STATION.

The old power plant of the Metropolitan Electric Company consisted of three buildings on Seventh Street near Franklin Street, containing the engines, generators, switchboards and regulators, with a large building in the rear extending to Lemon Street containing the boilers. The engineer's office, etc., was located in an adjoining building and another building was used to house the storage battery. The old arrangement is shown in Fig. 7. Building No. 1 was equipped with six small, horizontal, high-speed engines on the first floor, each belted to two small generators on the second floor. In addition a line of shafting on the first floor, driven by a Hamilton Corliss engine in an adjoining structure, drove two rows of dynamos and arc machines on the second floor. The equipment at the time of the rebuilding comprised fourteen 60-kw, 125-volt Edison bipolar machines; eighteen Brush, American and Wood arc machines; six small engines and one Corliss engine, with a rated output of 1200 hp and supplying the three-wire system and arc circuits. Switchboards for the entire three-wire system and generators, series arc circuits and series incandescent system were also located on the second floor. In an extension at the rear a 350-hp Green Corliss engine was added, belted through a jack shaft to a 2300-volt, 60-cycle, two-phase alternator. The switchboard for this unit was located near the end of the jack shaft. In 1894 building No. 2 was erected, in which were installed three vertical cross-compound engines, direct-connected to railway generators with a total rating of 1600 kw, a vertical cross-compound engine direct-connected to two 100-kw, 125-volt direct-current machines, and the railway switchboard. Further growth is represented by the erection of building No. 3, containing at first two Ide engines, one belted to a Short railway generator and a Westinghouse 2300-volt, 60-cycle, two-phase generator, the other belted to a Jenney multipolar generator and a Thomson-Houston railway generator. Later the direct-connected units, an Allis-Chalmers cross-compound engine driving a 500-kw railway generator and two Harrisburg cross-compound engines, one direct-coupled to a 350-kw Stanley, 2400-volt, 60-cycle, two-phase alternator, the other direct-coupled to two 300-kw, 125-volt direct-current generators, were installed. Other additions were three boosters and a railway battery and two 400-kw, 25-cycle Stanley rotaries, running inverted and supplying energy to two 300-kw substations through step-up transformers and a 15,000-volt transmission line. The final rating of the station was 7800 boiler-hp and 5000 kw of generators.

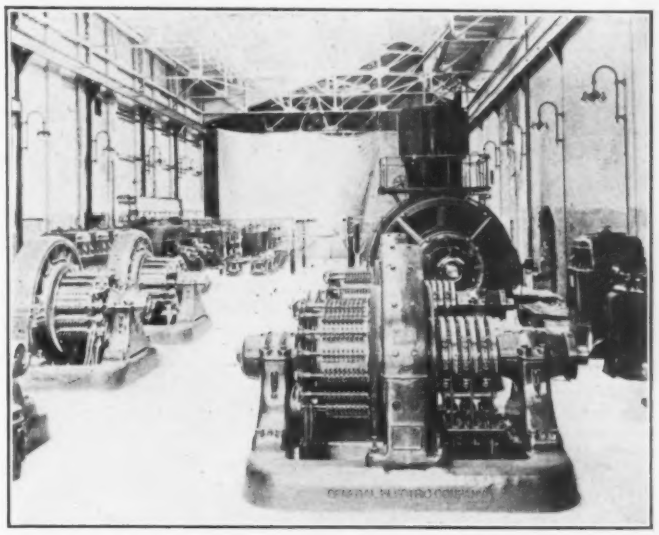


Fig. 2—Section Containing Lighting Rotators Before All Old Units Were Removed

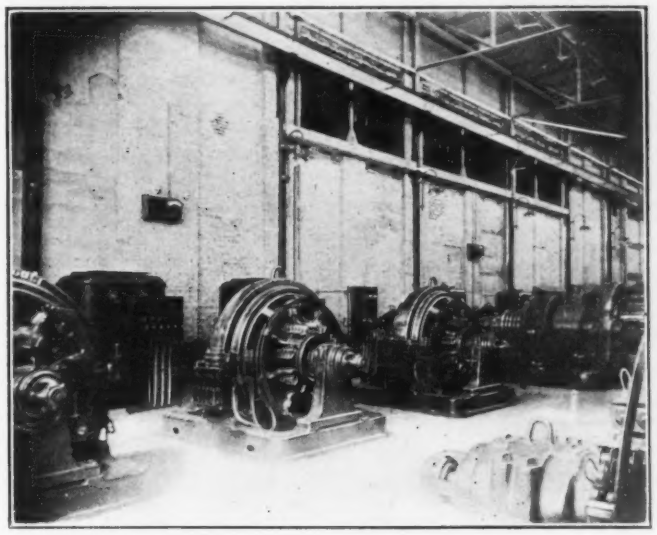


Fig. 1—Railway Units in Rebuilt Station

RECONSTRUCTION FOR USE AS A SUBSTATION.

The first undertaking was the reconstruction of building No. 1 without interrupting the operation of the apparatus.

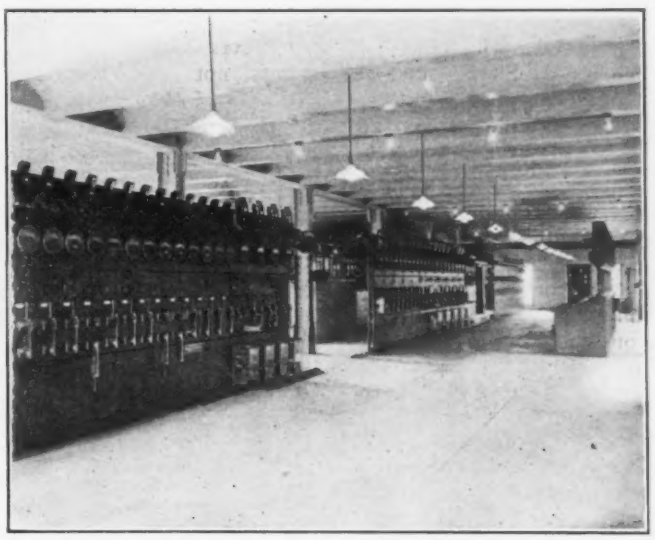


Fig. 3—General Arrangement of Switchboard Gallery

Reference to the photographs will show that it was possible to put in a single row of steel columns down the middle, which would support steel floor beams laid above the old wooden floors, so that the old floors should serve as forms for the new concrete floors, the machines being raised to the new level one at a time, the belts being lengthened and belt holes left in the new concrete floor to be closed up after the removal of all the old apparatus. The third floor being

built furnished protection to the apparatus, so that the old wooden roof could be removed and a concrete slab roof supported by steel trusses erected.

The lean-to structures on the side and rear end, which contained respectively the step-up transformers and the practically a solid mass of concrete foundations for the engines, shafting and generators which had been installed from time to time. Along the walls, however, there were trenches for steam pipes which, with a slight amount of additional work, could be used for the air tunnels over which the air-blast transformers were placed. In order to install the fiber conduits connecting the transformers and rotaries to the high-tension switching system it was necessary to raise the floor levels of both buildings sufficiently to permit these conduits to be laid on the top of the old engine-room floor, and this resulted in the switch-cell compartment floor being higher than the rest of

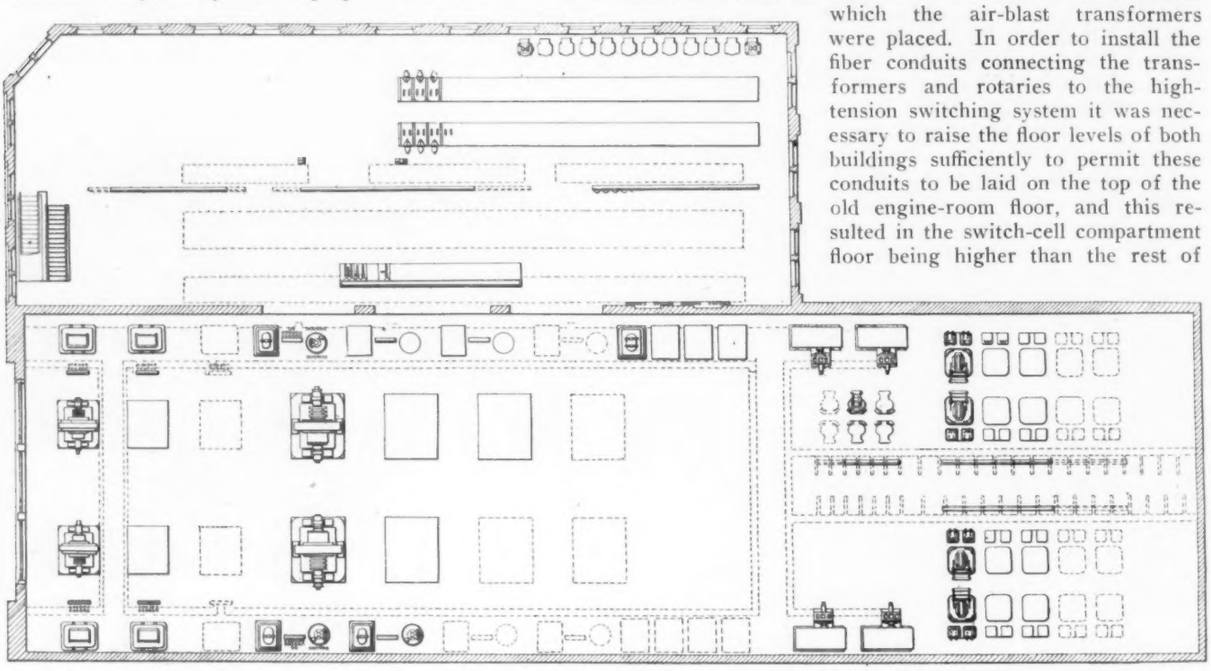


Fig. 4—Plan View of Station as Rebuilt.

Green-Corliss engine, were torn down, giving more yard room for the pole lines and improving the appearance of the property.

To give space necessary for the new equipment in building No. 2 an addition was made, extending into the old boiler house, the rear end wall being moved back. It will be seen that the rearranged plant, having 50 per cent greater capacity, occupies only 41 per cent of the ground space taken by the original plant.

In both buildings No. 1 and No. 2 the ground floors were the floor in building No. 1, which was made level with that of building No. 2, where formerly there was a difference of 9 in. in their elevations.

NEW INSTALLATIONS.

The substation receives high-tension current at 13,200 volts, 60 cycles, three-phase, through underground cables from the new generating station. Provision is made for connection to six of these cables and six high-tension switches were accordingly installed, four for present use and two for future needs.

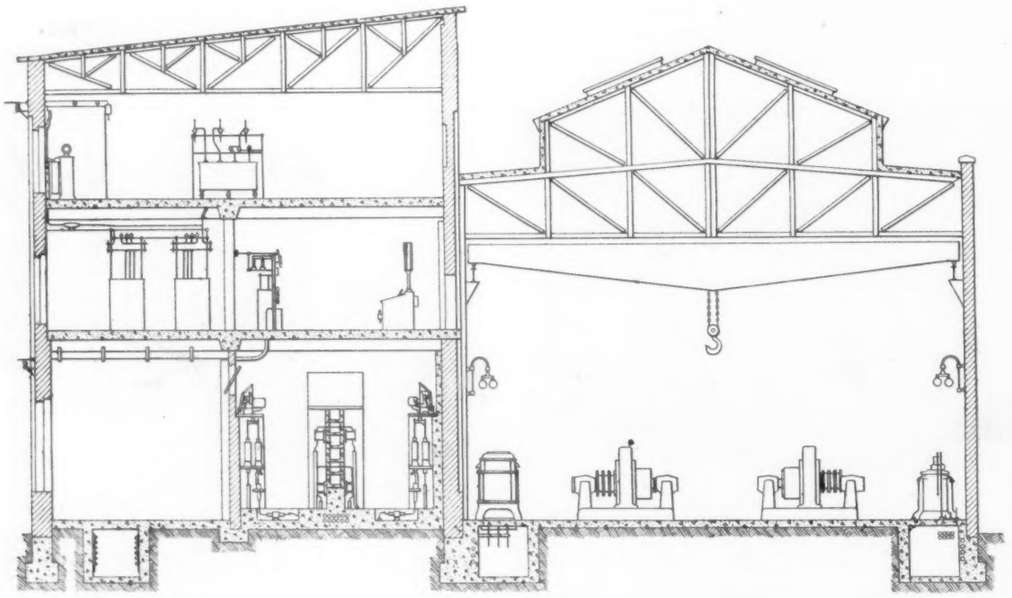


Fig. 5—Elevation of Main Portion of Rebuilt Station

From the substation energy is distributed for railway feeders (600 volts), direct-current three-wire system (125-250 volts), motor circuits (2300 volts, 60 cycles, three-phase), lamp circuits (2300 volts, 60 cycles, single-phase), series mercury arc and series tungsten street-lighting system. The rating of the equipment at present is 8000 kw. Provision is made for future installations amounting to 3000 kw, making the ultimate rating of the substation 11,000 kw.

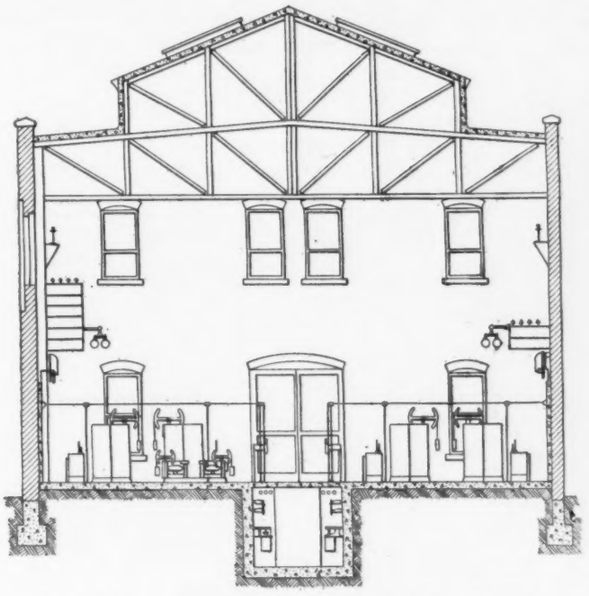


Fig. 6—Elevation of Street-Lighting Section of Station.

BUILDING NO. 1.

The first floor of building No. 1 contains the high-tension switches and busbars, office of the engineer in charge and the arc-lamp and meter-repair department. The second floor, used as a switchboard gallery, contains the 2300-volt switches and all of the switchboards except those used for the street-lighting system. The benchboard is located in front of an opening in the wall which gives the operator a full view of the rotary-room floor. The benchboard controls all of the high-tension switches which are located on the first floor, and the 2300-volt switches located on the second floor for the control of the low-tension side of the distribution transformers. The switchboard for the 2300-volt system is a vertical board controlling all the outgoing 2300-volt circuits. These switches are of the remote-control solenoid-operated type arranged in two banks. Over each bank is located a set of three busbars. This arrangement provides a duplicate system of switches. Normally, one bus is to be used for three-phase motor feeders and the other for the single-phase lamp feeders, connected to separate transformers, so that the irregular motor loads cannot affect the lighting. In case of trouble either bus can carry either the lamps or motor feeders, or both, and any transformer can supply either bus or both. The switchboard for the direct-current three-wire system is composed of rotary panels and feeder panels. The same arrangement is carried out in the railway switchboard. These three boards are arranged in one line facing the benchboard, so that everything is in full view and easy reach of the operator. Sufficient space is left between the vertical boards for future extension in the number of panels for feeders as well as for rotaries.

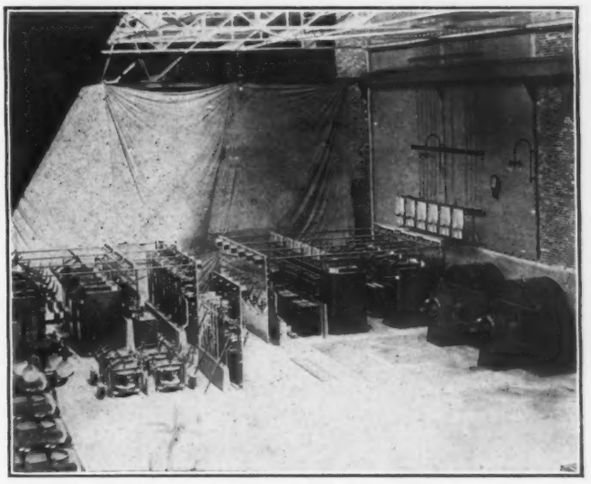


Fig. 8—Tungsten and Arc Boards for Street-Lighting Circuits.

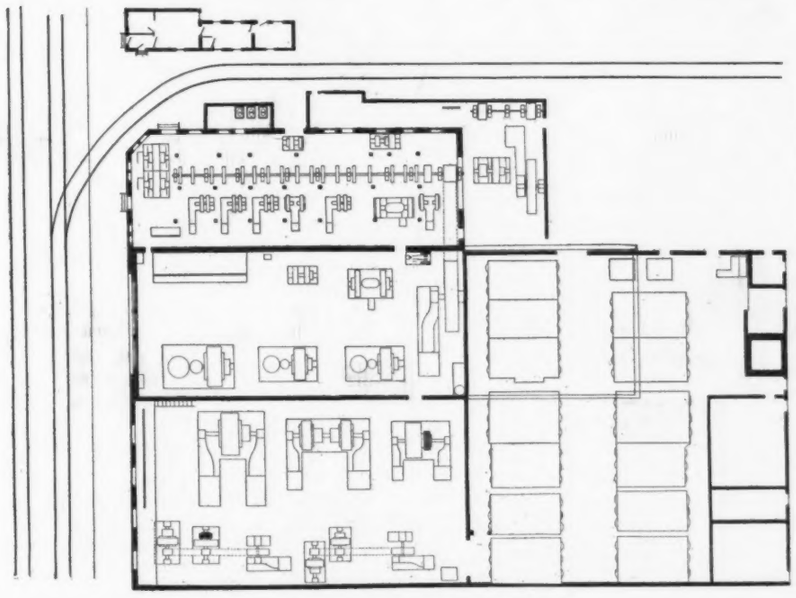


Fig. 7—Layout of Old Station.

BUILDING NO. 2.

This building contains the railway rotaries and transformers, lighting rotaries, transformers and regulators, 2300-volt transformers, blowers for cooling all of these transformers and regulators, the tungsten and arc regulators and switchboards. Underneath the switchboards for the arc and tungsten systems is a tunnel which contains the 13,200-volt bus supplying these systems and, in compartments, the oil switches which are operated by connecting rods carried up through the floor to the back of the panels. It will be noted that all connections between the switchboards and apparatus in this building are in conduit under the floors.

HIGH-TENSION SWITCHES AND BUS SYSTEM.

The high-tension switches are connected to a main bus which is in three sections and an auxiliary bus which is

in two sections. By this means, and the use of two bus-section switches, it is possible to isolate any line which is carrying a badly fluctuating load, and, if necessary, this line may be isolated to the main bus in the generating station, or still further, by means of the auxiliary bus, to one generating unit in the main station.

Two auxiliary switches are provided which will, by means of the auxiliary bus, replace any regular switch which may be out of commission, thus doing away with the necessity of providing duplicate feeder and transformer switches. This saved space and first cost.

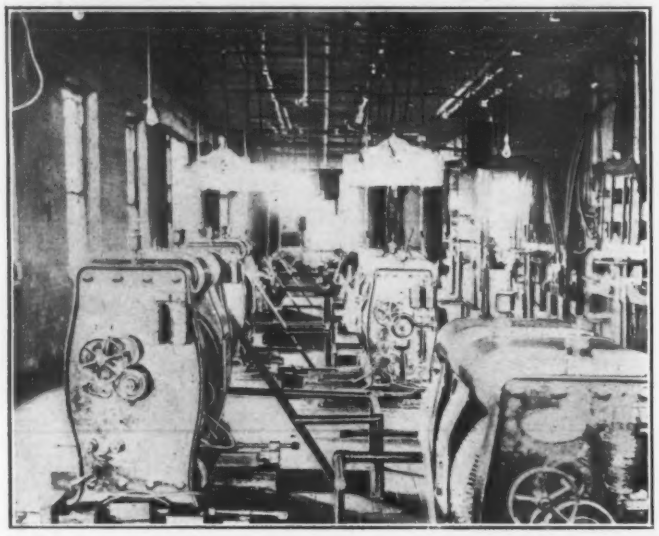
OUTGOING LINES.

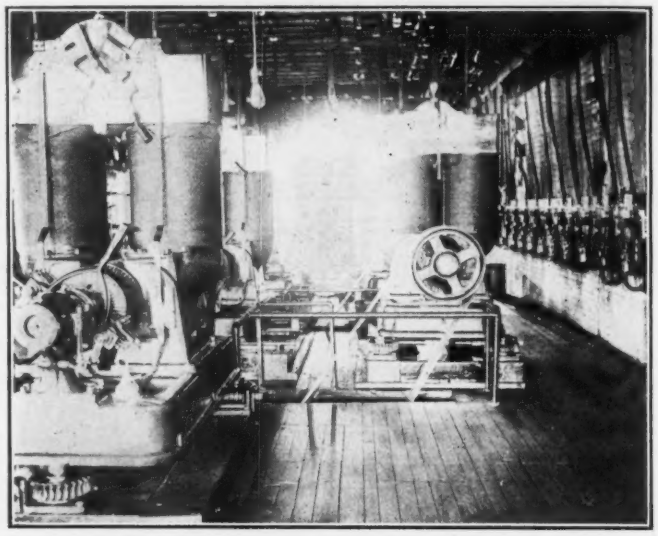
At present the railway, lighting and motor feeders are taken out of the side of building No. 1 and the street-lighting circuits out of the Lemon Street end of building No. 2; all circuits being overhead. The railway ground enters with the high-tension underground conduits at the front of building No. 1, where it is connected to a bus in a manhole under the floor. The negative of each railway rotary is connected to the ground bus. The neutral for the direct-current three-wire system is connected to a bus in the tunnel. From here separate cables are connected to the low-tension side of the rotary converters feeding the lighting load by means of switches on the rotary starting panels. Only the positive and negative leads are carried to the distributing switchboard on the second floor.

A tunnel running from front to rear under the floor of building No. 1 provides connection to a future underground direct-current three-wire system. This tunnel can be extended to Lemon Street and Seventh Street, which will thus be the trunk of the underground system.

OPERATING DETAILS.

All rotaries are of the six-phase type and start from the alternating-current side, through low-voltage taps, without reactances. They are arranged with speed governors. The 2300-volt lines and the street-lighting lines inside the buildings are, with their lightning arresters, supported on pipe framework so that they present a neat appearance and are easily accessible. Lighting rotaries are regulated on the alternating-current side by six-phase, induction-type, air-blast, motor-operated regulators controlled from the switchboard gallery. The 2300-volt, single-phase feeders are automatically regulated by oil-cooled, motor-operated regulators controlled by contact-making voltmeters. The series mercury-arc and tungsten circuits are regulated by air-cooled, constant-current transformers in which the movable coils are balanced by weights.





Figs. 9, 10, 11 and 12—First and Second Floors of Station Before Changes Were Made.

The electrical equipment and the architectural and structural changes were designed by Mr. Walter J. Jones, consulting engineer, 30 Church Street, New York City, who also supervised the construction and the process of dismantling the old apparatus and installing the new. All switchboards, switching and controlling apparatus, lighting rotaries, transformers and regulators were furnished and installed by the General Electric Company. The rotaries and transformers for the railway systems were furnished by the Westinghouse Electric & Manufacturing Company.

HYDROELECTRIC DEVELOPMENT IN THE BLACK HILLS.

MEN who were boys twenty years ago can remember the glamour that surrounded the Black Hills and the thrilling tales of the Deadwood coach. The Black Hills are still notable for their mining development, gold and other metals and minerals being found there; but the western portion of South Dakota, in the neighborhood of Rapid City particularly, is experiencing a marked era of industrial development.

The Dakota Power Company of Rapid City, S. D., is building an interesting hydroelectric development on Rapid Creek, which rises in the Black Hills, and, after passing through Rapid City, empties into the Cheyenne River, which, in turn, finds its way to the Missouri River. The company controls the water rights on Rapid Creek from Pactola, at an elevation at the headgates of the reservoir there of 4440 ft. above sea level, to the eastern limits of the Black Hills forest reserve, which is the terminus of the company's water-power rights and is at an elevation of 3350 ft. In addition a 30-ft. fall in the creek at Rapid City is utilized.

Above Pactola, which is west of Rapid City and upstream, the area drained by Rapid Creek is about 410 sq. miles. The source of the creek is found in a large number of springs, the flow of which, excepting during flood conditions, is very constant. Records taken for twenty years past show a minimum flow of 60 cu. ft. per second. This flow can be very materially increased by the use of storage reservoirs. A small reservoir is now formed at the headgates at Pactola, and is shown in Fig. 2 of the accompanying illustrations. It is proposed to form other reservoirs at the various water-power developments down the creek.

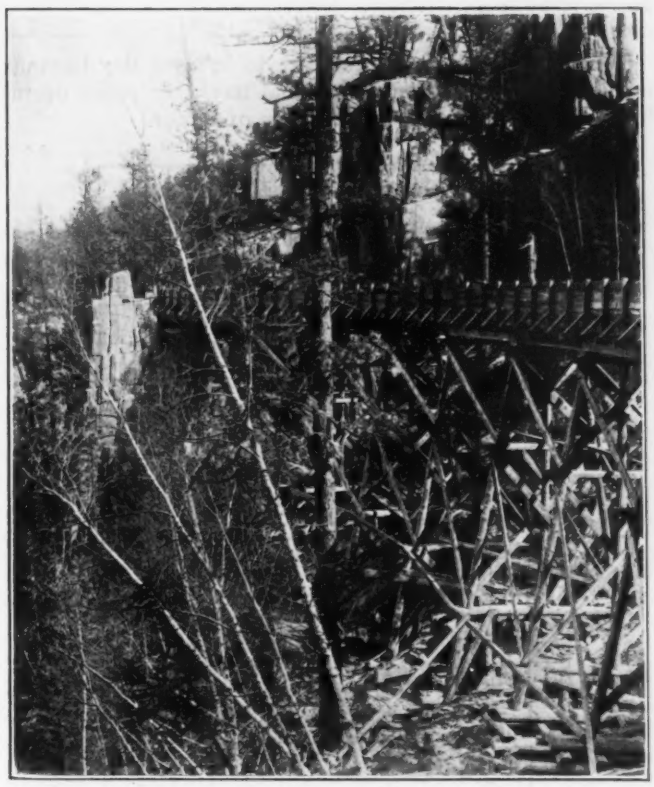


Fig. 1—Trestle and Rock-Cliff Construction of Flume.

These reservoirs will be of ample capacity to carry the peak load over a considerable period. As soon as all the available power is contracted for a much larger storage reservoir can be constructed at comparatively small expense.

At Pactola the company has installed a substantial rock-filled pile-and-crib dam properly aproned both above and below, which turns the water into a well-constructed waterway, three miles of which is completed. The greater part of this waterway consists of a wooden flume 6 ft. wide and 4 ft. deep, the remainder being open ditch or cuts through the rock. In Fig. 1 there is shown a view of the trestle and rock cliff construction that was adopted in building the flume.

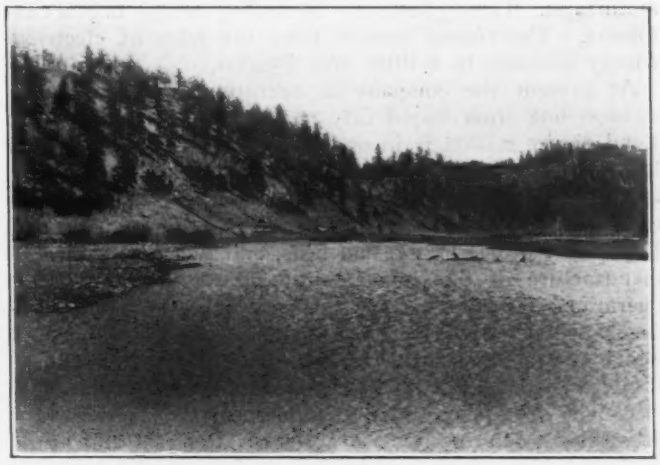


Fig. 2—Storage Reservoir at Pactola, S. D., on Rapid Creek.

At one place it is necessary to carry the waterway through a 700-ft. tunnel cut in the rock, and work on this tunnel is now under way. From the mouth of the tunnel the water will be carried through a 62-in. wooden pipe line to a forebay 6250 ft. distant. This forebay is formed by erecting a small concrete dam across the mouth of a draw, thus providing. a storage of 700,000 cu ft. of water. From near the bottom of this dam the water will be conducted in another wooden pipe line 3250 ft. long to a steel penstock and through this to the waterwheels in power house No. 1, at an elevation of 4140 ft., the effective head being 270 ft.

Power House No. 1 will be located at Big Bend, on Rapid Creek, about 12 miles west of Rapid City. The power-house foundations and floor are of concrete and the walls of brick. The main building will be 70 ft. long and 35 ft. wide, with a transformer room 35 ft. square. Contracts have been entered into with the S. Morgan Smith Company for three 800-hp turbine waterwheels of the Francis type and two turbine waterwheels of the same type rated at 70 hp each. These waterwheels will drive three 500-kva, 2400-volt alternators and their exciters. The generators and the necessary switchboards, transformers, etc., will be supplied by the Westinghouse Electric & Manufacturing Company and both the electrical and hydraulic machinery have already been shipped.

After the Big Bend power house is completed a second development will take the water just below the tailrace of the first plant and carry it to an elevation of 3890 ft., where, with an effective head of 225 ft., 1225 hp can be developed at the minimum flow of the creek, or 2040 hp at peak load. It is proposed to erect further developments down the creek in the same way, and thus an additional 2718 hp at low water and 4530 hp at peak load may be obtained.

The Dakota Power Company is now operating one steam plant and one combination steam and water-power plant at Rapid City. The steam plant consists of three 300-hp horizontal tubular steam boilers and two 200-kw De Laval steam turbines connected to 2400-volts, three-phase generators. The building in which this apparatus is installed, as well as a separate building for 24,000-volt transforming apparatus, is of concrete and cement-block construction. This plant was erected by the company during the summer

of 1910. The combination steam and water-power plant, which was purchased from the Rapid City Electric and Gas Light Company, contains one 150-hp register gate Victor waterwheel, to which is belted a 100-kw three-phase Westinghouse 2400-volt generator. Here, also, is a 150-hp Corliss engine, with the necessary boilers and other steam auxiliaries. These plants are furnishing energy to 700 customers. The annual income from the sales of electrical energy amounts to a little over $50,000.

At present the company is operating a 7-mile transmission line from Rapid City north. As soon as the Big Bend power station is in operation a 30-mile transmission line southwest of Rapid City will be built to furnish energy to several mines for motor applications and to light several villages and small cities. In the immediate vicinity of Rapid City are large gypsum beds, and two plants for the manufacture of this mineral into plaster are already in operation. Another use for electrical energy from the hydroelectric plant will be in the lime, cement and brick plants which are using the native rock and clay just north of Rapid City. A still further opportunity for the use of electricity is afforded by irrigation projects, as there are between 200,000 and 300,000 acres of land east and south of Rapid City which can be irrigated to good advantage when electrical energy for pumping is available.

The Dakota Power Company is incorporated under the laws of South Dakota, and its officers are as follows: President, Mr. John C. Haines, Rapid City, S. D.; vice-president, Mr. F. M. Stewart, Buffalo Gap, S. D.; secretary and treasurer, Mr. G. R. Mansfield, Rapid City, S. D. Mr. W. R. Putnam is the general manager.

APPLICATION OF MOTOR DRIVE TO BRICK PLANTS.

By Gordon Weaver.

THE application of electric-motor drive to machinery used in the manufacture of bricks presents a comparatively new and interesting field. As this is essentially a summer load, the business is particularly attractive from a central-station standpoint. The question of steam for heating purposes rarely, if ever, is presented, and where steam is used in the manufacture of bricks it may be economically supplied at low pressure.

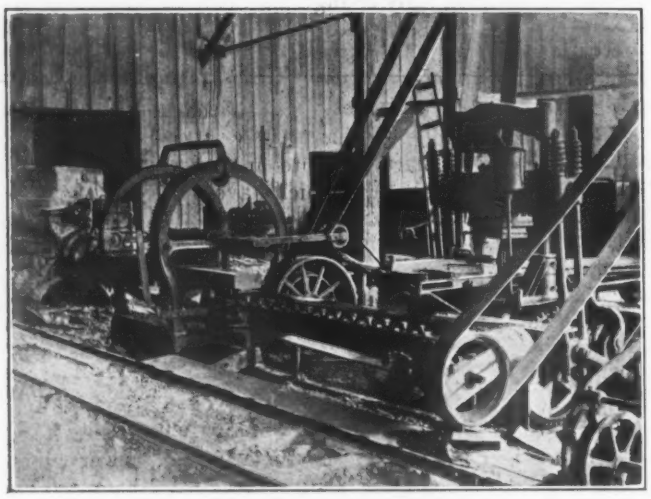


Fig. 1—Wire-Cut Brick Machine Belted to Line Shaft.

The power required to drive different machines varies considerably, depending largely upon the kind of clay used. For rough estimates it is fair to assume a connected load of 20 hp for each 10,000 bricks capacity per day. In plants having a capacity of 20,000 per day or less it rarely pays to install more than one motor, as practically all the machines operate at the same time. Figs. 1 and 2 show part of the machinery of a brick plant belted to line shaft and

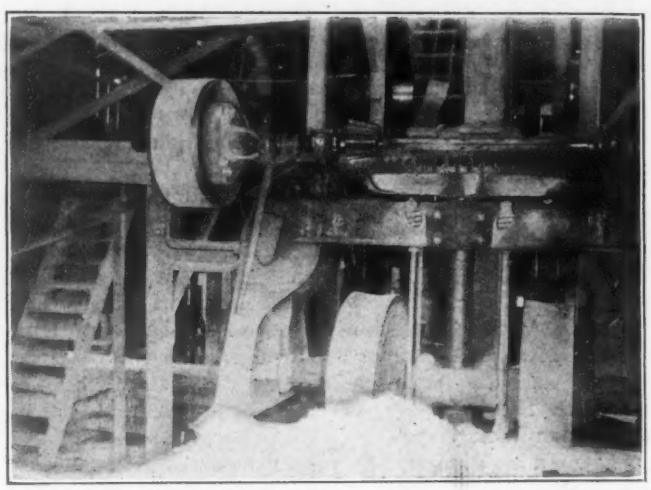


Fig. 2—Frost Dry Pan Belted to Line Shaft.

operated by one motor. In large plants (i. e., over 20,000 capacity) diversified motor application is very practical and gives satisfactory and efficient service.

Machine.	Demand in Kilowatts.
Forty-inch disintegrator	50.4
Pug mill	44.
Wire-cut brick machine, 50,000 brick per day	64.
Four mold dry press	6.

Where a number of motors are to be used the demands tabulated above, as found by actual test, may prove useful in the selection of the proper sizes of motor.

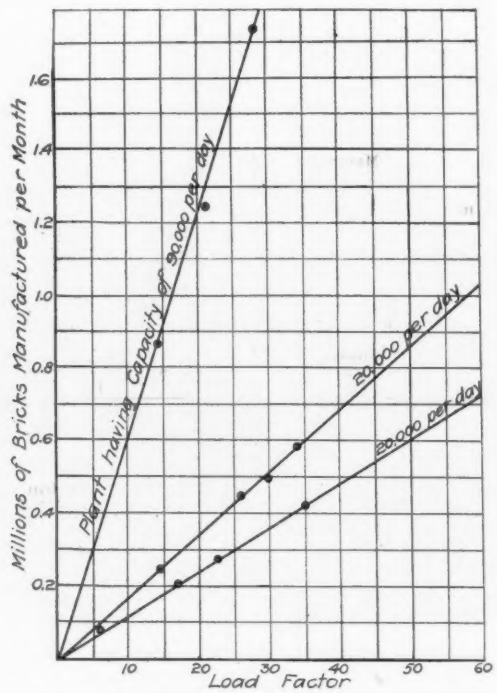


Fig. 3—Diagram Showing Variation in Load-Factor with Output.

These demands are all in terms of the actual power required, the motor efficiency not being taken into account.

If it seems advisable to run the elevators by separate motors the energy required to drive them may be easily

calculated in foot-pounds. One cubic foot of clay weighs 125 lb. The horse-power thus calculated will be about 50 per cent of that actually needed.

The monthly load-factor varies with the monthly output,

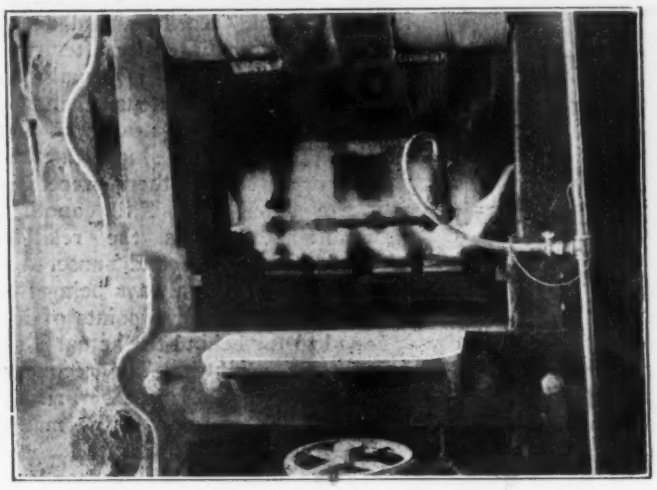


Fig. 4—Brick Press Having Dies Heated by Gas Flame.

capacity of the plant and the character of the clay. Fig. 3 shows the variation in a plant having a capacity of 90,000 bricks per day, and also shows the effect that different kinds of clay have on the load-factor of two plants, each having a capacity of 20,000 bricks per day. The load-factor in these diagrams is calculated on the basis of 720 hours per month and a five-minute demand.

When a central station approaches on the subject of motor drive a brick company that is operating by steam the

BRICKMAKING DATA.

		Maximum Demand Kilowatts.	Kw-Hours, Output.	Thousands of Brick.	Load-Factor, 24 Hours.
Plant having 90,000 capacity per day; connected load, 170 hp (4 motors); 12.7 kw-hours per 1,000 bricks.	April	116	23,900	1,744	28.6
	May	107	19,900	1,636	825.
	June	96	16,250	1,249	23.5
	July	96.5	9,900	871	14.2
	August	88.24	13,290	1,025	20.9
Plant having 20,000 capacity per day; connected load, 50 hp (1 motor); 14.8 kw-hours per 1,000 bricks.	March	25	4,980	336	27.8
	April	25	4,640	435	35.8
	May	25	6,310	426	35.0
	June	25	6,390	432	35.6
	July	25	4,060	274	22.5
	August	25	4,470	302	24.8
	September	25	4,190	282	23.3
	October	25	3,070	207	17.1
	November	25	1,070	76	5.9
	December	25	.....	.....	....
	January	25	.....	.....	....
	February	25	4,610	310	25.7

DRYING.

Plant having a capacity of 90,000 per day; connected load, 50 hp on drying system alone.	April	48.5	24,950	1,090	71.
	May	50.3	22,900	1,266	63.
	June	47.4	21,025	905	61.5
	July	43.7	10,175	380	32.3
	August	49.4	12,670	576	35.5

company will assert that steam is needed to heat the dies on the brick press. It is true that the dies must be heated, but there are three different ways whereby this is now being done, each of which has its advantages and will prove the most economical in some localities.

The first method which logically suggests itself is that of supplying steam from a small auxiliary boiler at low pressure. This is being done in quite a number of places and is proving very satisfactory. A boiler of this sort requires very little attention, as almost anyone around the place can do the little firing necessary. In a plant having a capacity of 20,000 bricks per day about 50 lb. of coal will be used per day in heating the dies. The second method is to have the heat supplied by a gas flame coming in direct contact with the dies. Fig. 4 shows the arrangement of the gas pipes on a four-mold dry press with the gas lighted and ready for operation. The gas actually used during one day was 600 cu. ft. in molding 18,000 bricks. The third method is to have the dies heated electrically. In at least one place this is being done successfully, flatiron cartridge heaters being used on each die. The energy used on a four-mold dry press will be about 40 kw-hours per day of ten hours.

Aside from the motors used in driving the machinery that makes the brick, motors are frequently used to drive a blower in connection with the drying system. The hot air is taken from the kilns which are cooling (in a large plant there is almost always a kiln in the process of cooling) and forced in through a drying-room where the bricks are tempered before being put into the kiln for burning.

The accompanying tabulations will give some idea of the maximum demand, kw-hour consumption, number of bricks manufactured and the monthly load-factor.

THE EFFECTS OF SUNLIGHT ON THE TRANSMISSION OF WIRELESS SIGNALS.

By B. L. Dolbear and J. A. Proctor.

SINCE the early days of wireless telegraphy it has been well known that the night is a much more favorable time than day for the reception of signals from stations over 150 miles distant. The difference between day and night intensity is not measurable at 100 miles, but at greater distances the night intensity is often as great as 100 times that of the day. Besides this day-night difference, another interesting phenomenon presents itself, namely, the rapid change of energy received from moment to moment. An inaudible signal will often be multiplied to 100 times audibility within the space of a few seconds; sometimes it remains so for several moments, sometimes for only a few seconds, but eventually disappears as suddenly as it appeared. This phenomenon is called "swinging," and while formerly it was thought to be due somewhat to local conditions at the transmitting station, it is now explained by the constantly changing conditions of the atmosphere, which vary the percentage of atmospheric absorption of the incoming signals. The reason why "swinging" is hardly noticeable at distances under 100 miles may be attributed to the fact that any marked changes in percentage of ionization due to irregularity of the sun's emission probably take place at quite an appreciable altitude. Hence, only the wave-fronts which have traveled some distance (probably corresponding to the minimum distances at which "swinging" is noticed) and which have reached an altitude which includes the ionized portion will be subject to absorption or loss of energy.

Until recently no data have been published showing definite measurements of the relative intensity at different times of day and night. At Amesbury, Mass., in 1909 Mr. Greenleaf W. Pickard carried on a series of measurements on intensity of signals as received from the Marconi transatlantic station at Glace Bay, Cape Breton. This station is about 700 miles from Amesbury, and at the time Pickard took his readings the radiating wave-length was approximately 4000 m. Fig. 1 shows the plotted results of Mr. Pickard's measurements. Owing to lack of data between the hours of 5 a. m. and 3 p. m. of July 26 points were plotted from two days' readings. It will be noted that the normal night-time intensity is between thirty and forty times that of the normal daytime intensity.

Last March the authors carried on another series of similar observations of the Glace Bay station signals as received at Revere and Somerville, Mass., each place about 4 miles from Boston. These observations covered six entire days within a period of two weeks, and on some of the days simultaneous measurements were made at both stations. As the stations at Revere and Somerville are only 5 miles apart, it would be supposed that the relative energy received at each station would be the same, which proved to be true as curves taken simultaneously check each other very satisfactorily. Figs. 2 and 3 show typical curves as taken at the two stations.

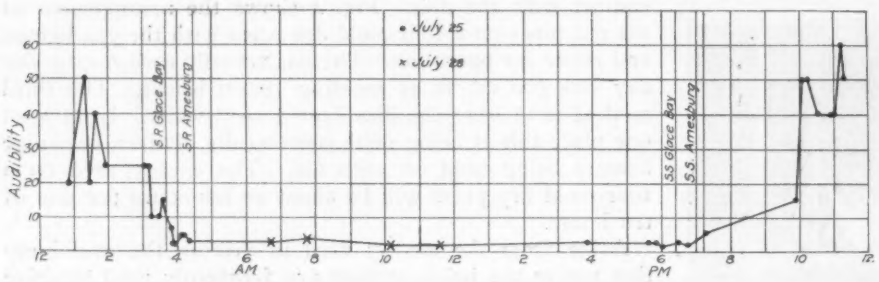


Fig. 1—Curve Taken by Pickard at Amesbury, 1909.

By far the most striking feature of these curves is the effect of sunrise and sunset on the intensity of signals. In the early days of wireless telegraphy Marconi noted a difficulty in communicating over long distances at sunrise and sunset during the experiments in transatlantic communication carried on between the steamship *Philadelphia* and Poldhu, England. Pickard's curves of 1909 show a slight dip at these times, especially at sunrise. Pickard found the point of lowest intensity about midway between sunrise time at Glace Bay and sunrise time at Amesbury. However, in Figs. 2 and 3 it is interesting to note that the points of minimum intensity occur at sunrise at Glace Bay and sunset at Boston. Two things should be taken into consideration in comparing Pickard's curves with the authors'. First, his readings were taken in July and the authors' in March, and, second, the transmitting station was employing a 4000-m wave-length in 1909 as compared to a 7100-m wave-length at the date of the authors' measurements. The latter fact might explain the absence of such wide fluctuations of intensity from minute to minute during the night in Figs. 2 and 3 when compared with Fig. 1. It is well known that longer wave-lengths are less subject than shorter wave-lengths to loss of energy by atmospheric absorption.

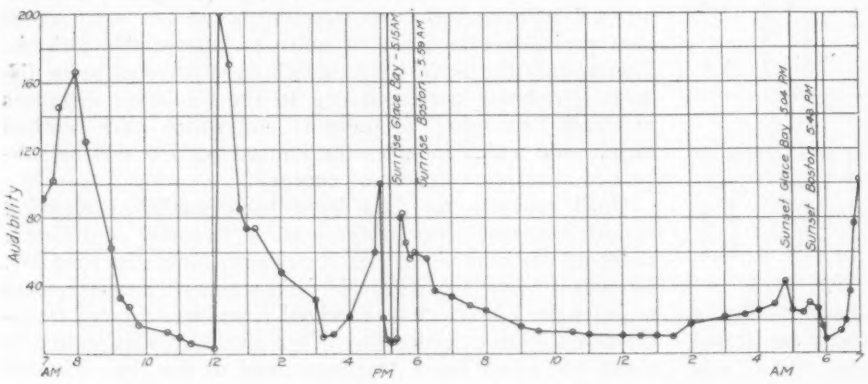


Fig. 2—Curve Taken by Proctor at Revere, March 13-14, 1911.

A general average of all the curves is shown in Fig. 4, which embodies other interesting features. There appears on many of the curves a slight rise of intensity between noon and mid-afternoon. Corresponding to this between midnight and 2 a. m. there is almost sure to be a sharp rise, followed by a gradual decline, until shortly before sunrise at Glace Bay. Just before taking the plunge preceding, and again at the recovery of intensity after sunrise and sunset, there is usually a quick oscillation of intensity unmistakably noticeable on nearly all the curves. Besides this single fluctuation there are often others preceding and following it. Still another noticeable feature is the relative width of the sunrise and sunset depressions, the latter always being the broader. The minimum points of intensity will generally be found to lag behind the actual sunrise or sunset time by some five minutes. The recovery of intensity after sunrise is perhaps the most surprising feature. In one case this recovery represented the maximum intensity for the whole twenty-four hours.

It seems impossible with the meager data on hand to give a fully satisfactory explanation of these various features. It has been suggested by some that the low daytime intensity is due to ionization of the atmosphere by the sunlight, which causes a dissipation of energy by conduction in the space between the transmitting and receiving stations. This appears to explain in a general way the phenomenon, but when it is considered that only the ultra-violet component of the sunlight produces ionization to any degree, and that these ultra-violet rays penetrate only a short distance into the atmosphere, it becomes evident that only the higher altitudes of the air are ionized, and this should not affect that portion of the wave traveling below this stratum unless it be proved that there is an upward passage of energy to compensate for the conduction losses. Neither does ionization satisfactorily explain the recovery of intensity after sunrise or before sunset. However, this sunrise-sunset effect may be due to entirely different causes and the ionization may be responsible for the effects which take place between sunrise and sunset.

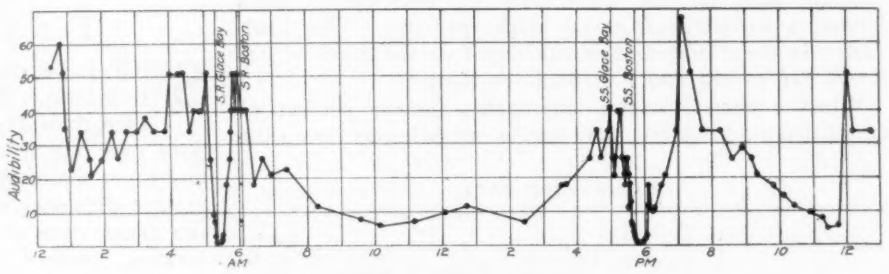


Fig. 3—Curve Taken by Dolbear at Somerville, March 11, 1911.

Others have contended that the upper stratum of ionized air may reflect the electromagnetic waves. However, as a definite line or surface of division must exist between substances having different physical properties in order that reflection may take place, this theory does not seem possible. There are no reasons to suppose that such a line exists under the ionized stratum. Fleming has pointed out that there may be a gradual refraction upward of the wave front, which might produce distortion of the wave.

If it were known that there was such a thing as interference between ether waves traveling in the same plane, a possible explanation of the sunrise-sunset effect might be

given, but as two rays of light may be made to cross each other at any angle without the slightest displacement or refraction it hardly seems likely that any such action could take place with the electromagnetic waves.

An attempt was made to obtain information regarding possible changes of transmitting conditions at Glace Bay, such as variation of power transmitted at different times of day, but without success up to the time this article was written. Without such data and more curves taken at other times of the year it hardly seems wise to enter into an elaborate discussion of possible causes, and, as it is believed that others have as yet unpublished theories to offer, it is hoped that this article may prove an inducement for those persons to give their opinions.

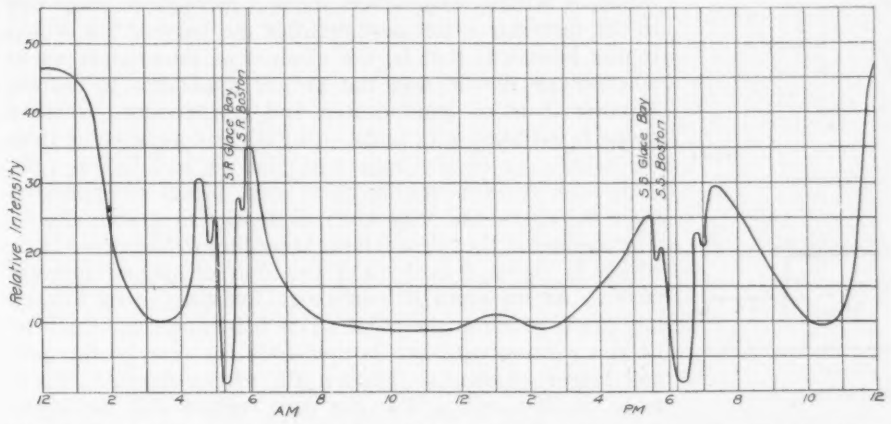


Fig. 4—General Average of All Curves Taken at Somerville and Revere, March, 1911.

The method employed in obtaining these readings is that of shunting the signals in the telephones to an audibility of unity. This is done by connecting a simple resistance box across the telephone terminals and by manipulating the plugs till a value of resistance is found at which the shunted signal is just audible. The greater the incoming energy at the receiving station, the louder the signal, and hence the less the shunt resistance required to reduce it to an audibility of unity. From resistance-audibility curves drawn for the particular telephone used, the value of audibility may be scaled, given a shunt resistance. With a little practice such readings may be confined within 10 per cent error, as shown when checked by galvanometer.

In taking such readings it is, of course, necessary that all inductances, capacities, couplings and adjustments should remain fixed and constant throughout the test. Once adjusted the inductance, capacity and inductive couplings will remain so unless intentionally changed, but the detector is subject to loss of adjustment from strong atmospheric disturbances and sometimes from slight mechanical jars. To retain equal sensitiveness at each adjustment a different method was employed at each station.

At Somerville a low-voltage 60-cycle current was employed in connection with a galvanometer. It is known that the efficiency of a detector of the solid rectifier type, such as is used in radio-telegraphy, is independent of the frequency used. When an alternating emf of a few hundredths of a volt is impressed on the detector circuit, and a galvanometer is connected in place of the telephones, a maximum deflection of the galvanometer, obtained by adjusting the detector, indicates maximum efficiency of rectification. The galvanometer and source of supply may then be cut out and the telephones replaced ready for reception of signals.

At Revere a simpler yet very reliable method was used employing a special form of test buzzer with platinum contacts. Across the contacts of the buzzer was connected a condenser of about 0.5 microfarad in series with a single turn of inductance, thereby producing an oscillatory circuit. This loop of wire was placed some 4 ft. from the receiving oscillation transformer, and at such an angle that with the buzzer in operation the oscillations set up in the loop of wire were just audible when the detector was adjusted to its highest point of sensitiveness. It is known that there is a limiting point of sensitiveness to every detector, and it is on this adjustment only that the buzzer is heard. The buzzer should, of course, be carefully muffled in some soundproof material.

The solid rectifier used in these observations was that combination of zincite and bornite known as the "perikon" detector.

The value of resistance corresponding to a given value of audibility depends upon the telephones used—that is, upon their impedance. The current divides at the shunt according to the impedance of the two circuits. The impedance of the telephones used in these tests was approximately 10,000 ohms to the detector currents, while the impedance of the shunt resistance, being non-inductive, is its true resistance. Thus a signal just audible with a 10,000-ohm shunt indicates an actual audibility of 2; with a shunt of 5000 ohms the audibility is 3, etc. A curve showing the relation of audibility to resistance offers a means of rapidly ascertaining audibility from shunt readings. A better method is that of constructing a resistance box with a dial switch graduated to read directly in terms of audibility.

The results of these observations have brought forth some very novel and interesting features, and it is the hope of the authors that at some later date, with more data at hand, the phenomena will be more fully discussed.

DEPRECIATION.

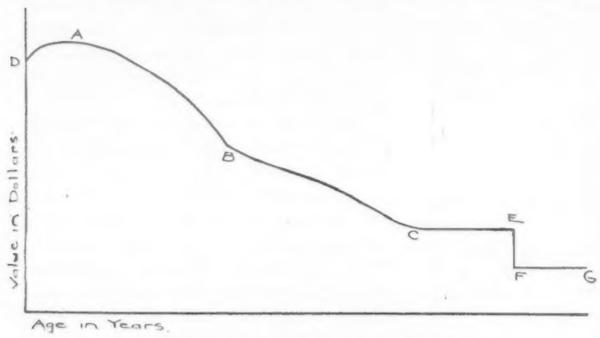
BY H. G. D. NUTTING.

The paper presented at the recent Chicago convention of the American Institute of Electrical Engineers by Mr. Henry Floy on "Depreciation" is a comprehensive summary of the best ideas on depreciation. It brings forth those of so many authorities that, after studying it, the reader is somewhat at a loss to realize what depreciation is, after all. He is, however, quite sure to realize that depreciation exists and that if the investment is to be preserved intact a depreciation reserve fund, accumulated from income, must be carried. The great value of this conclusion lies in the protection of the investor in public-utility securities against loss of principal brought about by fictitious and unearned dividends.

As is stated in Mr. Floy's paper, the total depreciation or the rate of depreciation in any given case depends upon specific conditions. He shows six possible ways in which property depreciates. History of apparatus shows that there may be an indefinite number of ways in which it may depreciate. This is proved by the accompanying statistics, which give the actual history of many pieces of machinery collected while the writer was inspector for the Wisconsin Railroad Commission.

It is necessary, when making practical use of depreciation, to know what the object is. It is plain that if an appraisal is being made the past history of the plant and the business is known, and fairly accurate estimates of the future can be made. If it is a question of fixing upon a depreciation reserve, that is, if the depreciation is to be estimated from the accountant's standpoint, it is a much more difficult matter to be certain of the results. It is safer to charge to depreciation a conservative average fraction of the investment in the plant than to try to estimate

to any degree of accuracy the life of each individual class or piece of apparatus, although, of course, such estimate should be at least tentatively made in order to determine what is a conservative average rate of depreciation on the whole plant. There should be no fear that this rate figure will be too large, as the hazard is likely to be greater than expected; and, while the public must meet the charges in



Curve Showing Depreciation of Apparatus.

the long run, the public gains by better service and finally better rates due to the good condition of the business.

The writer has noticed one item of inaccuracy, or rather incompleteness, in connection with Mr. Floy's table of ap-

HISTORY OF MACHINERY SHOWING DEPRECIATION.

Boiler No. 1.—Age 20 years. Rebuilt when 11 years old. Carries 110 lb. pressure.
Boiler No. 2.—Age 18 years. Used only for heating system. Not safe to carry high pressure. About to be removed.
Boiler No. 3.—Age 8 years. Still in good condition. Has had new set of tubes. Used only for reserve.
Boiler No. 4.—Age 16 years. Apparently in good condition. This boiler was replaced one year later on account of being too small.
Boiler No. 5.—Age 16 years. Carries 100 lb. pressure and runs all the time.
Boiler No. 6.—Age 19 years. Carries 100 lb. pressure and runs most of time.
Boiler No. 7—Age 37 years. Taken out of electric-light plant and now carrying 95 lb. pressure in manufacturing plant.
Boiler No. 8.—Age 23 years. Carries 85 lb. pressure. Apparently in good condition.
Boiler No. 9.—Age 20 years. Carries 95 lb. pressure, operating continuously.
Boiler No. 10.—Age 35 years. Taken out for lack of capacity. Run several years without washing.
Boiler No. 11.—Age 18 years. Run one year in electric plant, stored 14 years and then put in water-works. Carries 130 lb. pressure.
Boiler No. 12—Age 19 years. Run two years and reset. Now carrying 85 lb. pressure.
Engine No. 1.—Age 6 years. In good condition, but used as reserve for larger unit.
Engine No. 2—Age 15 years. Taken out on account of being too small. Now for sale. Overhauled three months before removal.
Engine No. 3.—Age not known. Bought second-hand and taken out because engineer thought cylinder was cracked.
Engine No. 4.—Age 26. Runs 12 hours a day and still in good condition.
Engine No. 5.—Age 19 years. Still running in good condition.
Engine No. 6.—Age 1 year. Gas engine. Used to carry peak only.
Engine No. 7.—Age 11 years. Apparently in good condition, but not in use. Bought second-hand and discarded because too small. For sale.
Engine No. 8.—Age 17 years. In fair condition. Has had new cross-head and has been rebored.
Engine No. 9.—Age 16 years. Still running. Has been rebored. New valves and valve gear, new cross-head and bearings.
Engine No. 10.—Age 22 years. Dismantled five years ago (age 17 years). For sale.
Engine No. 11—Age 18 years. Partly rebuilt two years ago. In good condition, but used as reserve in plant now turned into high-tension substation.

proved rates used in estimating theoretical depreciation. The practice of the Wisconsin Railroad Commission in making a valuation is not to use the straight-line method, but rather a "4 per cent compound interest depreciation curve." Further, the condition of the apparatus appraised is noted; that is, with respect to whether it is in good, fair or poor condition. If in good condition, 100 per cent of the condition per cent on basis of life is taken; if in fair condition 90 per cent of its life per cent is taken, and if in poor condition only 80 per cent is taken. Whether the apparatus is in good, fair or poor condition is necessarily determined by the inspector, who must check his conclusions by the use of a fair degree of common sense and good judgment.

If the history of any given piece of apparatus is studied, it will be noted that its life curve is not a regular curve dropping according to any one algebraic equation. The curve reproduced shows roughly what takes place in the life of the average piece of apparatus. For example, assume an ordinary Corliss engine has been installed. Point *D* represents its value in dollars at the time of installation. Shortly after installation, when it is working in good condition, it actually experiences a slight increase in value due to the fact that it has accomplished the purpose for which it was intended; that is, the element of uncertainty as to whether or not it was the proper apparatus to install, whether it is of good design and construction, whether properly installed, etc., makes it of slightly more value than the mere cost of the apparatus plus its installation cost. This peak is more prominent in some pieces of apparatus than in others and may even disappear in certain cases. The apparatus then depreciates according to the curve *A B*, which is assumed to be a 4 per cent compound interest curve. At the point *B* another critical turn in its history is passed, which is the point when it becomes too small to be run continuously and is used only for reserve for new and larger apparatus. Section *BC* of the curve is likely to be much longer and flatter than section *AB*, its length depending in a measure upon the apparatus for which it is being used in reserve. At *C* another slight change is made and the life curve takes the form of a straight line parallel to the base. This is the line of minimum service value and marks the limit of useful value of the machine, terminating at *E*, when its life as a machine is ended and it is scrapped. Manifestly, it can never be worth less than scrap value represented by *FG*, which continues indefinitely.

It cannot be said that all pieces of apparatus follow this curve exactly. The curve does, however, represent in a general way the history of the average piece of apparatus working under normal conditions.

It is rationally impossible, therefore, to use any set method of depreciation for all kinds of physical property regardless of conditions. However, it is probably true that the result of using such a method on the appraisal of a public-service property with its diversified physical equipment will result in a reasonably correct figure for present value.

AMMETER TESTING.

By G. C. Cassard.

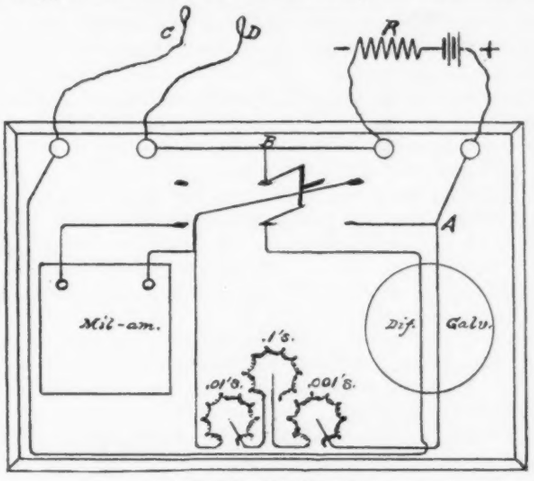
There are two generally recognized methods of calibrating direct-current switchboard ammeters under operating conditions. In the first, or "direct," method a standard ammeter (or shunt and millivoltmeter) is connected in series with the shunt of the meter to be tested, and the reading of the latter is compared directly with that of the standard. In the second, or "potentiometer," method the drop across the shunt is measured by using a potentiometer and the corresponding current is taken from a table previously compiled and compared with the reading of the switchboard meter.

The writer has no intention of comparing the merits of these two methods, but would point out that any method necessitating connections directly to live copper and depending for its load variation on manipulation of the outgoing current is objectionable and should not be tacitly accepted without an effort to substitute something more efficient.

If it were possible to measure the small shunted current in the instrument itself, for instance, and to know what scale deflection such current would produce, it would be quite practicable to substitute this current by using a small battery and rheostat, and thus to make the test in a position as remote from the switchboard as desired. The several resistance factors involved would have to be known, however, to accomplish this result, taking account, of

course, of the actual temperature at which any test might be made.

As an imaginary case, suppose that, instead of using a shunt, the ammeter leads have been simply tapped to the outgoing copper at points 3 ft. or 4 ft. apart to provide the necessary drop. This introduces a temperature coefficient in this part of the circuit and is assumed simply to present a case involving this factor. To measure the resistance of this copper section it will be necessary to disconnect the



Ammeter Testing Set.

ammeter leads and measure the drop between these points with a potentiometer. At the same time the current is measured by means of a portable ammeter connected in series. Thus, from Ohm's law, the resistance of this copper or "shunt" at the observed temperature of the test is obtained. Now by applying a temperature constant, as given in standard tables, this resistance may be immediately reduced to its value at a standard temperature of 75 deg. Fahr. Thus, calling the latter resistance R and X the resistance at an observed temperature of, say, 66 deg., $R = 1.02\,X$, since 1.02 is the constant indicated at this temperature. This value R is then stamped on the shunt, and, since it is unchangeable, it constitutes a permanent record.

To measure the resistance of the ammeter leads it is only necessary to attach a bridge to their lower ends and to remove the upper ends from the meter and bolt them together. This observed resistance is then reduced to its standard resistance at 75 deg. just as was done with the shunt, and this standard, r, is then noted on a tag and tied to the leads.

It will be understood that the above work is preliminary and need be performed only once, so long as absolutely reliable results are secured. The values obtained are obviously unchangeable and may be used in testing for an unlimited period. There remains then only one resistance to be measured—that of the ammeter itself—and this measurement must necessarily be made every time the meter is checked; indeed, every time the tester changes the internal calibrating coil, which is usually of a metal having a zero temperature coefficient and is included in the circuit of the copper coils of the instrument. This fact has no bearing on the results, however, since the total resistance in series is used at the observed temperature of the test, and is, therefore, not to be affected by a constant. R and r, on the other hand, must be reduced to the room temperature before being used, and since they were multiplied by a factor before to bring them to a resistance at 75 deg. it will be necessary to divide them by a factor.

By reason of the constant relation that the shunt and meter bear to each other at all loads, and by the simple law of two multiple circuits, $\frac{R}{K} : \left(\frac{r}{K} + r_1\right) = i : I$, in which R is the shunt resistance at 75 deg. Fahr.; r is the resistance of the ammeter leads at 75 deg. Fahr.; r_1 is the observed resistance of the ammeter; K is the temperature factor at observed temperature; i is the current in the meter circuit, and I is the current in the shunt.

From the above proportion $I = \frac{i\,(r + r_1 K)}{R}$ is obtained as the value of the current in the shunt, but, as the current through the meter is too small to be read on its own scale, this value may be taken for the total current external to the shunt. The tester may, therefore, take the meter from the board and after connecting up to a suitable bridge and milliammeter, and measuring the resistance and current, the meter may be calibrated by above formula.

In applying a system of testing such as this it is evident that recourse must be had to an instrument of special design, which, while possessing a reasonable degree of simplicity, will lend itself readily to the measurement of both the resistance and the small meter current, and this without undue manipulation. These considerations were applied in designing the testing set described herewith, which may be made up in a form compact enough to fit into a small suitcase.

It will be seen by referring to the accompanying drawings that the double-throw switch provides for the uses mentioned by changing the arrangements of the circuits. The measurement of resistance is made with the switch thrown to the right. In this position there are two subcircuits. Starting from the positive side of the battery one of these circuits passes through the right side of the differential galvanometer, the resistance dials, the upper blade of the switch and returns to the battery. The other circuit, starting from the positive side, passes through the lower blade of the switch, the left side of the galvanometer, the terminals C D (supposing the terminals to be bolted together) and back to the battery. The two circuits from the junction A to the junction B are of equal resistance when the three resistance dials are set at zero; therefore, any outside resistance connected between C and D may be accurately measured to thousandths of an ohm by balancing the galvanometer by the dials. By attaching these terminals to the binding posts of the meter its internal resistance is first measured. Since this same connection is used for the current measurement the tester may proceed by simply throwing the switch to the left. Now there is only one circuit, starting at positive, right side of galvanometer, resistance dials, milliammeter, lower blade of switch, left side of galvanometer, ammeter on test and back to the battery. In this position the galvanometer is not in use, but the milliammeter is, and it is found desirable to pass the current through the galvanometer twice for three reasons: First, since the current is the same in the two coils it will not deflect the needle; second, the increased resistance of the series connection added to that of the milliammeter which has just been switched in reduces the current flow when calibrating, so that greater battery strength may be used to give the galvanometer greater sensitiveness when balancing, and, third, with the series connection the galvanometer itself may be checked as to whether or not it is perfectly differential.

In the calibrating position of the switch it makes no difference in the accuracy of the ammeter how much resistance is in circuit, provided the resistance of the calibrating coil inside the ammeter is not changed. This seems inconsistent until it is remembered that a change in the calibrating coil means a change in the ratio of the meter to its shunt—that is, a change in the value of one factor (r_1) of the formula, which change should only be made in changing the calibration. So for varying the load the dial resistances are varied, but not read, the actual checking being made by the reading of the milliammeter as compared with the ammeter.

"BY-PRODUCT" ELECTRIC-LIGHT PLANTS.

Prof. George H. Morse, of the department of electrical engineering at the University of Nebraska, read a paper on "Electric Lighting By-products" before the Nebraska Electrical Association at Lincoln recently. This paper aimed to give a résumé of the various ways in which an electric-lighting company may improve the character of its load-factor without greatly increasing its equipment or the size of its operating staff. He defined the ideal by-product as one necessitating the least outlay for additional apparatus, the least expert knowledge different from that required for the main output of the company, the least money tied up in raw material, least attention from the technical staff and the fewest obligations to the trade supplied.

The 80 or 90 per cent of heat energy going to waste in exhaust steam cannot be used to produce electricity, and hence must find application in some lower order of by-products. For the use of this the manufacture of artificial ice seems the best application. In general the operation of cold storage does not commend itself, because of the great responsibility and the careful and costly supervision necessary. The use of the exhaust steam for heating involves an outlay of capital and a public obligation equal to if not more than that required of the electric-lighting plant.

There is perhaps no industry in which a suitable by-product is so much needed as in electric lighting. The plant equipment and organization are highly specialized, and yet for the major portion of the time are bringing in no adequate return on the investment. If there were a reasonably cheap means of storing electrical energy all efforts could be directed to the production of this one commodity. The plant would then go on doing its work the same at all hours, all fluctuation in demand being met from the stock of electrical energy in storage. Storage batteries do not meet the requirement on account of their high cost, low efficiency and high rate of depreciation.

The special encouragements offered to off-peak consumers of electricity tend to produce a market for what may be termed by-product energy, since it is often sold at or near cost. Electric flatiron load is off the peak and very desirable. Electric cooking load seems to offer less inducement, because of its tendency to come on about the time of morning and evening lighting. It is also in competition with cheaper sources of heat.

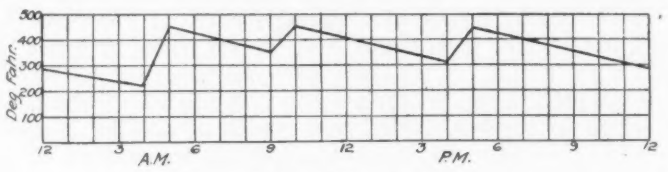
Local thermal storage on a small scale may be made to solve the problem of supplying off-peak energy for cooking. The idea is to supply electrical energy to consumers at desirable hours; that is, hours desirable from the standpoint of station operation. The energy thus supplied is stored for use as heat in a well-insulated receiver on the premises of the consumer. A clock would be used to switch the energy flow on and off at the desired hours.

In connection with the paper a fireless cooker with a vacuum jacket was shown. The walls of this cooker are in the form of an air-tight metallic chamber filled with a powdered material. Twenty-five pounds of water (12 quarts) at 212 deg. Fahr. were placed in the cooker. At the end of fifteen hours the temperature had fallen to only 140 deg., the outside temperature being about 70 deg. This equals a rate of heat loss of 1.13 thermal units per hour per degree difference of inside and outside temperature. From these data the curve shown herewith was plotted. This curve was based on the use of a piece of soapstone weighing 70 lb. as a heat retainer. One may think of the stone as a cylinder 10 in. in diameter and 9 in. high, and provided with some form of electric-heating coil. The whole would be placed in a vacuum-jacket cooker. Referring to the curve, electricity is turned on at 4 a. m. and supplied at a rate of about 1 kw. At 5 a. m. a temperature of 450 deg. is reached. Energy is turned off at 5 a. m. and again turned on between 9 a. m. and 10 a. m., and also between 4 p. m. and 5 p. m. These are the hours during which the station load is light. Under these conditions the temperature within the cooker as calculated from the rate of cooling in the experiment above referred to would at no time sink below 218 deg. Fahr., which latter temperature would occur at 4 a. m. At all times it would be hot enough for most kinds of cooking. Of course, some allowance would need to be made for heat loss in heating up cold articles to be cooked, especially if the top were left open and the coffee-pot set to boil. The kw-hours supplied daily to keep the temperature at points shown in the curve is only 2.42. The monthly bill for this service at a 3-cent rate would be $2.18. The consumer would have at hand day or night a hot oven ready to cook food. A large cooker would show rapidly increasing economy compared to the space available within it for cooking. Increasing the thickness of insulation would also reduce the cost of operation.

Following are some of the common temperatures necessary for cooking. A potato will bake in 0.75 hour at 300 deg. Fahr. It will harden on the outside and almost burn at a temperature of 400 deg. Fahr. in 20 minutes. At 220 deg. from 1.25 to 1.5 hours are required to bake a potato.

Bread in small loaves should be baked at 360 deg. for 30 minutes. Frying is cooking in fat at a temperature of 350 to 400 deg. An 8-lb. turkey with stuffing should go into an oven at 400 deg. for 0.5 hour and then bake at 280 deg. for 2 hours longer.

Bleaching liquor prepared by the electrolysis of common brine is coming to be considered superior to that obtained chemically from bleaching powder. The Pullman Company has installed electrolytic apparatus for this purpose in its numerous laundries, and finds the liquid produced



Suggested Operation of Cooker.

also well suited to washing and disinfecting car floors. There are at present in the United States two companies manufacturing and selling electrolytic bleach machines to the laundry trade. These machines consist of little more than a mixing tank for the brine, an open electrolyzing tank, numerous carbon electrodes and a storage tank for the completed bleaching liquid. The relative cost of the electrical and chemical systems of producing bleaching solutions appears to be an unsettled question, with no decided advantage in favor of either method over the other when electric energy is obtainable at the usual rates.

The author said that the harmful effects of the electric bleach and the chemically prepared bleach of the laundries appear to be about the same when the chemical bleach is very carefully prepared and handled. However, in practical operation the carelessness with which the chemical bleach is ordinarily prepared causes it to destroy clothing at a much greater rate than electric bleach, since there is only a small opportunity for the latter to go wrong. It is claimed that knitting mills and artificial silk and woolen goods manufacturers are installing electrolytic bleaching equipment in large quantities. Great steamship lines have used such apparatus for six years past. It appears that well-informed people will ultimately demand the electrolytic bleach in laundries.

Electrolytic sodium hypochloride, which is the chemical name for electrolytic bleaching liquor, is a powerful sterilizing agent, and is used for the purification of drinking water and for other disinfecting purposes. On the whole the supplying of energy for laundry bleachers or the supplying of bleaching and disinfecting liquor in carboys at the lighting plant appears to be a promising and legitimate

enterprise, which offers opportunity for improving the load-factor at considerable profit if properly handled. Many enlightened households would eagerly seek an opportunity to obtain such a disinfectant in quantity at reasonable price.

By replacing the simple open electrolyzing apparatus just considered with one in which the products set free at the positive and negative electrode are kept separated by a porous diaphragm or by other means, caustic soda, free chlorine and free hydrogen are produced. The liquid surrounding the electrodes must be rapidly exchanged, otherwise these several chemicals will react upon one another to form the sodium hypochlorite or bleaching liquor, as in the open electrolyzer. These three products are prepared for the market in several ways. The chlorine may be absorbed by lime, which is placed on leaden shelves in an absorbing chamber. The caustic soda is recovered by evaporation and the hydrogen is either wasted or collected and sold. Another procedure is to permit the free chlorine and hydrogen gases to mix and subject this mixture to some physical influence, as for instance light, whereupon a chemical combination sets in which produces hydrochloric acid. The Niagara Alkali Company prepares all of these products in this manner. The processes yield about 1 lb. of bleaching powder and 0.5 lb. of caustic soda per hp-hour, which at the present market would produce a gross return of about 5 cents per hp-hour.

The author mentioned the use of cheap electrical energy for producing nitric acid for fertilizer manufacturers. He estimates the gross return for this purpose at from 2.5 to 3 cents per hp-hour.

Ozonized air is at present used in Germany for the sterilization of the water supply of several cities. The cost of treating water in these plants has been found to be about 0.5 cent per 1000 gal. It requires a little less than one hp-hour to sterilize 1000 gal. of water.

Another method of water sterilization in large quantities for municipal plants has recently come to the front in which ultra-violet rays of light obtained from the mercury-vapor lamp are used. In this process the lamp is made from a quartz tube instead of glass. The energy consumption in this process is 136 watt-hours per 1000 gal. Two lamps are sufficient to treat 10,000 gal. per hour.

BY-PRODUCT ICE.

Professor Morse gave estimates on an assumed case of an electric-lighting plant operating with and without an auxiliary ice plant. The conditions approximate closely those found in a certain lighting plant in Nebraska. The company serves a town of 5000 inhabitants. Coal costs $4 per ton, and water must be paid for at the rate of 7 cents per 1000 gallons. The plant cost $40,000, including distribution system. The peak load is 90 kw, and the yearly output 306,000 kw-hours. The plant runs twenty-four hours per day. The daily output in summer is 770 kw-hours, and in winter 930 kw-hours. The plant has compound condensing engines of the high-speed type and a cooling tower is employed for cooling the condensing water. The average coal consumption per kw-hour is 10 lb. when running condensing and 12 lb. non-condensing. The plant labor consists of one night and one day engineer in summer and a third engineer in winter. These men do their own firing. The yearly expenses of operating this plant condensing, including one manager at $2,000 and all labor on lines and in plant, together with water, oil, waste, plant repairs, taxes, fire, boiler and employer's liability insurance, office and legal expenses, are as follows:

Expenses as above	$10,000
1,530 tons of coal at $4	6,120
Depreciation on $40,000 at 8 per cent	3,200
Total	$19,320

The yearly receipts from all sources are $25,000. The plant, therefore, returns a net income on the investment of 14.2 per cent. He then assumes that a 10-ton by-product ice plant is added, which in the latitude of Nebraska will be used to make ice for six months in the year, remaining idle the succeeding six months.

A 10-ton exhaust-steam ice plant complete with machinery and chemicals in place, including a one-story brick building, 24 ft. x 53 ft., and an ice-storage room for two days' supply, will cost about $15,356. The only difference in the cost of operation so far as the lighting plant is concerned will be the two extra pounds of coal per kw-hour made necessary through operating the engines non-condensing. This extra coal he charges against the ice plant. The quantity of coal thus consumed during six months will be 131 tons, which at $4 per ton will be $524. The items of cost involved in the operation of the ice plant are as follows.

131 tons of coal at $4	$524.00
Annual depreciation on $15,356 at 10 per cent	1,535.60
7,200 gal. of cooling water per day for 180 days at 7 cents per 1,000 gal.	907.20
One night and one day attendant in ice plant for 180 days at $2.50 each	900.00
Two teams and two drivers, 180 days at $5 each	1,800.00
Four distributers of ice from wagons, 180 days at $2.50 each	1,800.00
Taxes and insurance	350.00
Rent of ground at $20 per month	240.00
Management and clerical work	1,000.00
Total	$9,056.80

Gross income from 1800 tons of ice, at 40 cents per 100 lb., $14,400. Annual cost of operating the combined lighting and ice plant, $28,376.80. Yearly receipts of combined plant, $39,400. Net annual income on total investment of $55,356 in combined plant is 20 per cent, as compared with 14.2 per cent from lighting plant alone.

Discussion.

Mr. L. J. Schwingel, of Holdredge, Neb., who operates a by-product ice plant with exhaust steam, led the discussion and expressed the opinion that an ice plant of the kind described in the paper should have considerable ice-storage space. He had tried operating without storage, but it did not work well on account of the variable demand for ice. The cost of maintaining the ice in storage is a deduction of one ton in the daily ice-making output of the plant. His plant is rated at 10 tons daily output, but is operated at 12 tons. The electrical energy required for operating pumps in the ice plant is 14 kw-hours per ton of ice made, which is high on account of the depth of 160 ft. from which cooling water must be pumped.

Mr. J. R. Cravath, of Chicago, said that he operates a combined electric-light, water-works and ice plant at Harrisburg, Ill. Of the three branches of the business he considered the ice business to return the best profit on the money invested. The design of combination of electric-light and ice plant calls for considerable study and engineering judgment as to the best kind of plant to install for a given set of conditions. Where cooling water is plentiful an absorption ice plant working on exhaust steam, like the one operated by Mr. Schwingel at Holdrege, Neb., is doubtless the most economical that can be installed. When, however, cooling water is limited or high in temperature there is a point where an exhaust-steam plant taking the exhaust from large engines will no longer be economical. It is then necessary either to install a compression plant, operated by an ammonia compressor, or an absorption plant using high-pressure steam. High-pressure steam can either be obtained from the exhaust of the pumps in the plant or as live steam from the boiler. If the plant is to be of the compression type, the question of motive power for the compressor is important. In some cases motor-driven compressors can be operated with the existing generating equipment of the electric plant without exceeding, during the summer peak, the maximum demand for lighting and motor service only in mid-winter. That is, the electric-plant equipment which would otherwise be idle in the summer can be used to drive the ice machine. Where a larger ice machine than this is neces-

sary it is advisable to install a steam-driven compressor.

Mr. C. C. Smith, of Exeter, told of some experiments made by putting electric heating units in common fireless cookers. These had given very good results. Mr. H. A. Holdrege, of Omaha, said that it is the duty of the manufacturer to develop the fireless cooker for electric uses, there being at present nothing really practical on the market.

Mr. G. A. Seabury, of the General Electric Company, said that his company has been working on cooking devices depending on the fireless-cooker, heat-storage principle for several years. A number of these are now in use at Detroit on trial, and from the results so far it looks as if something practical has been developed. These cookers require about 40 watts. Mr. Cravath expressed the opinion that the solution of electric cooking will be through the use of the heat-insulating principle of the fireless cooker and suitable heat storage so that electrical energy can be drawn from the lines in small quantities twenty-four hours per day, thus doing away with the necessity of high maximum-demand service charges. By drawing energy continuously instead of intermittently, as indicated by Professor Morse's curve, the cooker can be kept hot, and at the same time the actual demand will be very low. Mr. Seabury in answer to a question said that the cooker being developed by his company is along the lines indicated by Mr. Cravath. President B. C. Adams suggested that a very low rate can be made because of the low fixed charges by drawing a small amount of energy at a time and storing the heat. Professor Morse suggested that use can be made of a clock which will automatically turn the energy on to the cooker at hours when it is not being used for any other purposes in the house. He also suggested that if the temperature required is not over 212 deg. Fahr. the use of water will be better than soapstone for storing heat, as it stores more heat-units per pound than any other substance.

In discussing the storing of artificial ice Mr. Schwingel said that he had tried storage without refrigerating the storage. The results were not successful on account of the excessive melting. In one storage house of distilled water ice which he had filled the ice was honeycombed when the house was opened. His company now has a refrigerated storage room, kept cool by the ice machine, in which ice is stored as fast as made during seasons of the year when there is no demand for ice. Mr. R. E. Berger, of Fremont, formerly of Joplin, Mo., said that the ice and electric company at Joplin has storage for about 10,000 tons of ice. The cost of handling the ice and refrigerating this storage was found to be a large proportion of the cost of manufacture.

ELECTRICALLY OPERATED EMERGENCY DAM AT THE "SOO" LOCKS.

To protect its important ship locks at Sault Ste. Marie, Mich., from accident due to carrying away of the gates, such as occurred in the locks on the Canadian side of the "Soo" rapids two years ago, the United States government has just completed a modern electrically operated emergency dam of the swing-bridge type near the head of the lock canal, replacing the lighter protective dam formerly installed there.

The new dam structure is 308 ft. between centers of shore abutments, and is pivoted on a central island pier, giving a 108-ft. clear channel on each side. In general appearance the emergency dam resembles a swing bridge except for the extraordinarily heavy construction of its steel members and the presence of the wicket winding drums and mechanism on its deck. The structure is 25 ft. wide between truss center lines and weighs complete 2100 tons.

In case of accident to the gates of either the Poe or Weitzel locks, permitting the discharge of the flood from Lake Superior to the river below the locks, under the 20-ft. difference in level, the emergency gate, located in the upper-canal approach to the locks, is arranged to be swung across the channel and locked into the shore abutments, while from

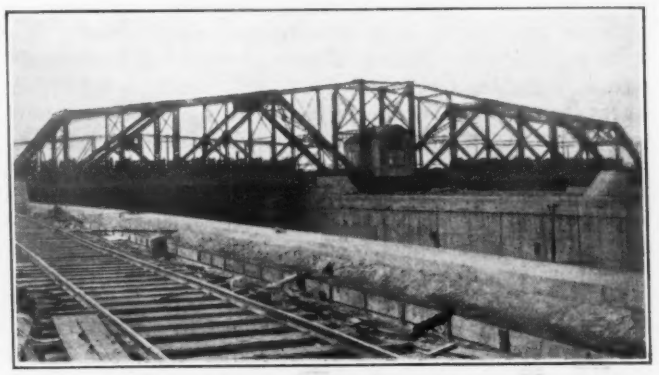


Fig. 1—Emergency Dam at American "Soo" Locks in Closed Position.

its deck thirty-two wickets, each 6 ft. 6 in. wide, are dropped in succession until the channel flow is entirely shut off. The wickets provided for this purpose are mounted to slide on rollers between steel girders hinged from the down-stream chord of the structure, but normally folded up under the bridge. Before dropping the girder frames the wickets are first run out to the upper or hinge end of the frames, which are then lowered and seat themselves against the 12-in. x 12-in. concrete-anchored oak sills at the bottom of the channels. After the empty frames have been dropped into position, the sliding wickets are then lowered in the frames, gradually arresting the flow of the water. The new emergency dam has been tested out under flood conditions almost equivalent to breakdown of the lock gates with a 20-ft. head and has shown itself fully capable of controlling and stopping the flow.

Electrical energy for operating the swing motion and wicket mechanism is obtained from the water-power plant of the Edison Sault Electric Company in the rapids of the St. Mary's River, ½ mile distant. The 60-cycle, three-phase energy is transmitted at 2300 volts, brought through cables in a shaft tunnel beneath the north channel, and

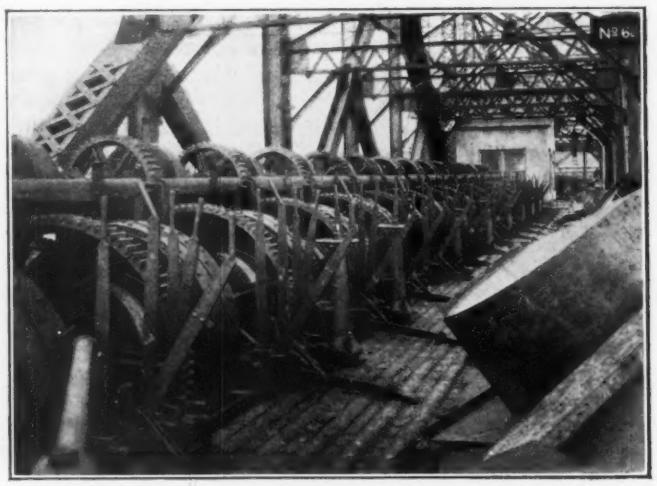


Fig. 2—Clutch Mechanism and Hoisting Reels for Wickets and Frames.

stepped down to 440 volts by three 100-kw transformers mounted on a concrete base near the center pier on the mid-channel island. This tunnel was constructed for the power cables, instead of employing submarine lines across the channel, in order to permit access to the dam for operating

it in case of flood. The tunnel, which is reached by vertical shafts at its ends, is 3 ft. wide and 6 ft. high, and its floor is about 33 ft. below the water. The tunnel is kept free of seepage water by a float-controlled, motor-driven pump.

The swing motion of the dam is operated through gear-

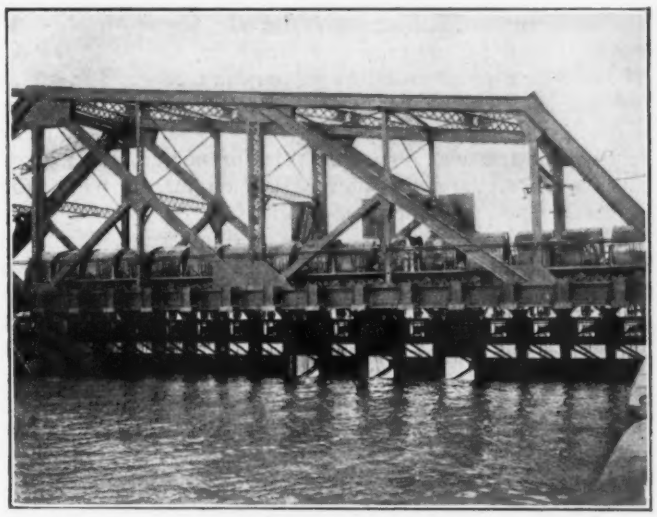


Fig. 3—Dam in Position, Showing All Frames Lowered and Wickets Being Closed.

ing by two 52-hp motors, either one of which is sufficient to move the structure in a heavy wind. Either or both motors can be manipulated from one or both of the duplicate controllers provided by changing the position of a double-throw switch. The sixteen frame and wicket mechanisms on each half of the dam are operated from a pair of line shafts extending out across the spans from the central deck cabin. Through clutches each shaft is driven by a 150-hp, 440-volt induction motor, a third clutch serving to interconnect the two shafts so that either or both motors may be utilized to work the entire gate mechanism. The girders and wickets are operated from these shafts by lever-controlled clutches.

The entire gate structure can be swung across the stream in less than ninety seconds and it is estimated all of the wickets can be lowered in less than sixty seconds more, which is the least time in which it would be practicable to interrupt such a flood of water.

The work at St. Mary's Falls Canal is in charge of Col. C. McD. Townsend, Corps of Engineers, United States Army. The dam was designed in the Sault Ste. Marie office under the direction of Mr. L. C. Sabin, general superintendent, his assistants, Messrs. I. DeYoung, C. A. D. Young and H. M. Edmands, being mainly responsible for the design. The dam was built under contract with Mr. Lawrence D. Weaning, Variety Iron & Steel Works, Cleveland, who worked out the details of trusses and machinery.

THE PRESENT STATUS OF THE LIGNITE GAS PRODUCER IN TEXAS.

Throughout the Southwest, and particularly in Texas, where lignite occurs in vast deposits, the development of a satisfactory gas producer capable of handling low-grade fuels has been looked forward to with the keenest interest by plant operators, especially in the smaller stations. During the last four or five years manufacturers have been busy experimenting with Texas lignites in their own factories, and two years ago several different producer plants guaranteed to handle low-grade fuels successfully were placed on the market by their respective makers.

Now after about two years' practical experience with the lignite gas produced in use it is interesting to note the varied results obtained in the Southwest with these new prime-mover units. Certain operators continue really enthusiastic at the results of producer operation; others insist that from its present form the apparatus will have to be much improved before the producer outfit will become a real competitor of the boiler plant. In several stations, at least, where producer-gas engines were installed this equipment has been ripped out bodily, presumably on account of dissatisfaction with its operation. In these cases steam engines supplied from lignite-burning boilers have replaced the producers. In some other former lignite-producer plants bituminous coal has now been wholly or partially substituted for the lignite. Several manufacturers have also practically withdrawn their lignite producer equipment from the market until its defects can be remedied.

The chief objection urged against lignite as a fuel material is the varied range of moisture which successive shipments from the same mine may carry. This lack of uniformity in the lignite results in inequalities in the gas given off and in other difficulties in producer operation. Trouble is also reported from producer plants required to meet rapid changes of load. The response of the producer to an increased demand for gas production if the load rises suddenly is generally quite sluggish and the engine may go dead from insufficient fuel supply. As most of the producers installed have been of the suction type, it seems out of the question to attempt to provide fuel-gas reservoir or storage capacity to meet sudden changes in load. This characteristic of the lignite producer to balk under irregular load-curve conditions ill adapts the producer engine to applications for electric-railway purposes in many cases where its low fuel cost and other advantages would make it very useful.

In discussing the lignite producer before the recent Southwestern Electrical Association convention at Houston, Tex., Mr. W. B. Head, general manager of the Stephenville (Tex.) Light & Water Company, recounted his own highly satisfactory experience during four years' operation, twenty-four hours daily, of a 100-hp up-draft producer plant doing both electric lighting and water pumping. The performance of this equipment Mr. Head characterized as unqualifiedly successful, whatever troubles were met with having been of a purely mechanical nature such as might occur with any internal-combustion engine. The Stephenville plant is run continuously twenty-four hours per day except Sundays, when it is shut down twelve hours for overhauling. The cost of fuel at 80 per cent load-factor has averaged under 5 mills per kw-hour. Mr. Head pointed out that, unlike steam plants of equivalent sizes, producer plants of even very small ratings share the high efficiencies and the economies of the larger sizes. While there are some cases, said the speaker, where he would not recommend lignite producer-plant installations, as for electric-railway work, yet in general he referred to the lignite producer as the coming form of power in the Texas district and declared that a dollar's worth of lignite contains more available potential energy than any other form of fuel.

Dr. A. C. Scott, of the University of Texas, remarked that the lignite producer may make possible electric service in many small communities where the operation of a steam plant would be out of the question. Dr. Scott also reported some analyses which were made on the moisture content of lignite samples. No sample taken from the cars showed more than 30 per cent moisture, he said, while lignite purposely soaked in water absorbed only 32 per cent of its weight. Dr. Scott recommended storing the lignite before use, allowing it to dry before firing into the producer.

In the discussion which ensued it was brought out that lignite producer-engine plants are operating successfully at Smithville, Mart, San Angelo, Blooming Grove and Corpus Christi, Tex.

GAS-PRODUCER PLANT EXPERIENCE AT HURON, S. D.

The Huron (S. D.) Light & Power Company has in operation a 450-hp producer-gas-engine plant which has now been in service a little over a year. The equipment comprises Muenzel producer-gas engines driving 2300-volt, three-phase, 60-cycle Fort Wayne alternators. A 300-hp twin engine drives a 200-kw generator, and a 100-hp single-cylinder engine, to be twinned later, drives a 100-kw generator. The fuel gas for these sets is obtained from a group of three 150-hp producers, equipped with wet and dry scrubbers, and so arranged that any of the producers or scrubbers can be used, as the station demand requires.

In describing his experience with these producer engines Mr. A. W. Wagner, manager of the Huron company, during a recent discussion, pointed out also some of the conditions required for successful producer-plant operation.

In planning a gas-engine plant, said Mr. Wagner, there are several items to which particular attention should be given. The foundations for the engines must necessarily be heavy. Some installations have suffered much, due to the fact that their foundations were not adequate. The same holds true of the building. Owing to the sudden air pressures a frail building would soon show the effects of operating gas engines. Good ventilation should be supplied for the comfort of the operators and for cleanliness.

Fig. 1—Producer-Gas Engine in Huron (S.D.) Plant.

Fig. 2—300-hp Twin Gas-Engine-Driven Generator Set.

The piping should be accessible, especially the exhaust pipe to facilitate replacing. Care should also be exercised to obtain sufficient gas for all engines under the most severe conditions. Neglect to do this will cause trouble due to engines robbing each other of gas, both in starting and during heavy loads.

The exhaust of gas engines will prove annoying if not properly taken care of. The introduction of water into the exhaust pipe will eliminate the noise, but should be barred on account of the deteriorating effect on the pipe and the danger of having an exhaust pipe filled with water. A properly constructed underground chamber, probably with baffling walls, will effectively eliminate exhaust noises. Any muffling device installed should be of sufficient size to prevent back pressure.

When the Huron plant was started the engines were subjected to operation under various loads, taking indicator cards to determine the load. The engines are rated in brake horse-power and guaranteed for 15 per cent overload. This is really a normal rating at the most efficient point of operation. It is not thought advisable to figure on operating the engines on overload, although during the test the engines carried considerable overload with uniform operation but a drop in speed. The installation has now been in operation for thirteen months. "We have had our troubles, to be sure," said Mr. Wagner, "but they have been less than we anticipated." Most of the trouble was with oiling devices and bearings. When the load is heavy there has been trouble with pre-ignition, due, no doubt, to the higher compression in the cylinder. This, however, can be prevented by more careful attention to the mixture of gas and air as the load comes on. There was also trouble with the engines and gas when the supply of water was inadequate. The remedy for this was obvious. With proper attention given the governor, the regulation of the engines is good, and especially good with the twin engine.

The quality of gas affects the operating results. Uniform and good gas requires good coal. The Huron plant has used anthracite pea coal only. Good results have been reported from the use of a mixture of pea and buckwheat, and also straight buckwheat. The coal should be stored so it will not become wet; and if it is dirty it should be screened. During the winter there is no trouble in obtaining clean, dry coal at Huron, but toward spring the coal becomes quite inferior, showing as large a difference as 25 per cent in thermal value.

Very good results have been obtained with bituminous coal and even lignites, using special producers and scrubbers, as there are more impurities (especially tar) in these coals. However, local conditions, as to cost of coal delivered and cost of handling, should determine which style of producer should be installed to obtain the best economy.

At Huron the attendant pokes the producers, shakes the grates and replenishes the coal about every three hours. The ashes and clinkers are removed from the bottom of the fire every twenty-four hours. The producer men soon find that they can supply good gas only by careful handling of the producers. If the poking is not done properly it will leave channels in which the passage of gas and the combustion of coal will localize. If the fuel is not well packed and distributed it will not support itself long enough to remove the ashes and clinkers in the daily cleaning. The formation of clinkers, due to poor fuel or improper cleaning and poking, has been the cause of much trouble with gas-producer plants. The vaporizer should be washed out about once a month. No repairs have yet been made on the Huron producers. After thirteen months' operation they appear to be in as good shape as when started. The excelsior in the dry scrubbers has been replaced, as should be done about twice a year. The wet scrubbers should have the coke replaced about once a year, depending upon the

quality of coal used and the temperature to which the gas is cooled. For washing and cooling the gas and cooling the engines about 20 gal. of water per hp-hour is required. The consumption of lubricating oil for gas engines is large. However, with care and the use of a good quality of oil it has been possible to reduce the oil bills materially.

Before going into the cost of operating gas engines the position which the gas engine takes in South Dakota should be pointed out. The water there is about as bad as can be found for boiler-feed purposes. It seems almost impossible to get rid of the scale, and hence the cost of maintaining boilers is high. On the other hand, the area in which flowing wells can be obtained is large, giving an abundant supply of cylinder-cooling water at no cost for pumping.

During the past year the Huron plant has operated at a station load-factor of about 20 per cent on the ratio of actual output to the twenty-four-hour capacity of the plant. The anthracite pea coal costs $8.40 per ton in the bin, the freight rate being $2.80 per ton. The monthly salary of the four men employed is $335. As the company has its own flowing well there is no charge for water, the first cost of the well being included in the cost of the plant. The original Huron installation included a gasoline engine for operating the air compressor and the blower for the producers. This engine has been replaced by an electric motor, retaining the engine as an auxiliary. This has considerably decreased the cost of blowing the producers and compressing the air for starting the engines. The labor charge is probably no more than it would be for a steam plant of the same rating. Charges for oil and waste are considerably larger than for a steam plan, probably twice as much, while the costs of packing, etc., are considerably smaller.

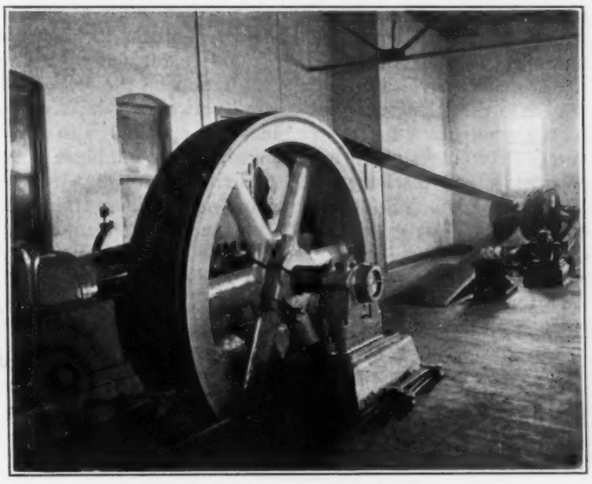


Fig. 3—100-hp Single Gas-Engine Set.

The results at Huron during the past year show a consumption of about 1.75 lb. of anthracite pea coal per hp-hour at the switchboard. Assuming the average efficiency from wheel to switchboard to be 50 per cent, this would be equivalent to a consumption of 1.4 lb. per brake hp-hour. The operation of the producers is found to be most economical when well loaded, while the engines work most satisfactorily with a surplus capacity of producers. This fact, and the time required to put into operation producers that have been standing by, brings up the question of gas storage. Local conditions determine the advisability of installing a tank for storing gas, but in all cases assist in making the installation more reliable. The objection, however, to having a supply of city gas available is that the operators, knowing that they have something to fall back on, may neglect their producers more than were they entirely dependent upon them.

In closing Mr. Wagner remarked that the reliability of a gas-producer plant depends upon its construction and the attention paid to it in operation. Without exaggeration, he said, he thought that with due attention a properly installed gas-producer plant will prove to be almost as reliable as a steam plant.

DEVELOPING MISSISSIPPI RIVER WATER-POWER AT KEOKUK, IA.

After six years of disappointing delays actual work on the great water-power dam developing the Des Moines Rapids in the Mississippi River near Keokuk, Ia., began in earnest with the present year, and the engineers in charge now confidently promise completion of the first 120,000-kw installation by July, 1913.

The Keokuk development, as outlined in the *Electrical World* of May 19, 1910, will comprise the construction of a concrete dam 4700 ft. long and 35 ft. high, flooding the present Des Moines Rapids and thus creating a head of from 25 ft. to 32 ft. for the power house, which is designed for an ultimate capacity of 200,000 kw. The building, which is on the Iowa side, running at right angles to the main dam, will be 1400 ft. long and 125 ft. wide. The construction of the dam will improve navigation in the Mississippi, replacing the present government canal and three locks around the rapids by a single lockage into the broad, deep lake created.

Preliminary work preparatory to the construction of the dam and power house is practically completed, and work is already well advanced on the Illinois end of the dam proper and on the wheel-pit excavations beneath the future power house. Protected by a cofferdam of rock-filled cribs, 36 acres of riverbed on the power-house site have been bared and pumped dust-dry, while an air-compressor power plant, electric-light plant, repair shop, offices, railroad drawbridge, concrete plant, steam shovels, conveyor hoists, etc., are already installed on the Iowa side. The work of excavating for the wheel pits is shown in Fig. 1. Already a prism 100 ft. wide, 30 ft. deep and 300 ft. long has been removed, and a similar section to the south is half completed.

Compressed air is used as motive power for all drilling operations and for the gantry cranes and hoists, dam traveler, etc. This air is piped from the compressor plants located on each side of the river, and is supplied to the movable structures through hose couplings which permit a few feet of movement without repiping. In Fig. 1 the compressed-air cranes are shown hoisting the stone spoil and dumping it onto cars, which haul it to the fill required by the relocation of the Burlington railroad tracks, whose present level will be submerged by the upper pond. The stone is loosened by drilling and blasting, while a steam shovel loads the material onto the crane spoil boxes, as shown in the picture. At the left and background of the illustration, inclosing the excavation, is seen the cofferdam which holds back the waters of the Mississippi.

On the east or Illinois side of the river construction of the dam itself is well advanced, as shown in Fig. 2, from a photograph taken July 13. Steel forms are used, the concrete being poured from the cantilever arm of the huge traveler crane which rests on the finished work. The small crane in the foreground is used for erecting the forms, and just behind the traveler is a similar small crane for dismantling the forms from around the finished arches. The concrete is mixed in the construction plant on the shore and loaded into 4-ton buckets on narrow-gage trains running out onto the work. Hoists pick the buckets from the cars and carry them on the trolleys to the point where pouring is being done. The operators for the three main trolleys are in cabins at the base of the cantilever and

manipulate their controllers under instructions by telephone from the pouring gang. Compressed air is used as the motive power for all this work. Twenty-two of the 36-ft. arches are now completed. The work is electrically lighted

Fig. 1—Excavating Power-House Wheel Pits in Riverbed near Iowa Shore.

throughout from engine plants in the two construction groups.

The building of the Keokuk dam and water-power plant is being carried out by the Hydraulic Engineering Company of Maine, a subsidiary organization of the Mississippi River Power Company, which owns the development and which succeeds the former Keokuk & Hamilton Water-power Company. When the project is completed it is understood that the Stone & Webster interests will operate the plant.

Transmission lines will be built to a number of nearby towns and cities, which have contracted for power. The principal line, however, will be the 100,000-volt transmission to St. Louis, 140 miles distant, where 66,000 hp has already been contracted for. Four circuits on two separate pole lines will probably be provided to the city limits, where the energy will be delivered to the substation of the Mississippi River Power Distributing Company, a North American Company subsidiary, for distribution to the local power-using and distributing companies.

The officers of the Mississippi River Power Company are: President, Mr. Edwin S. Cooper; vice-presidents,

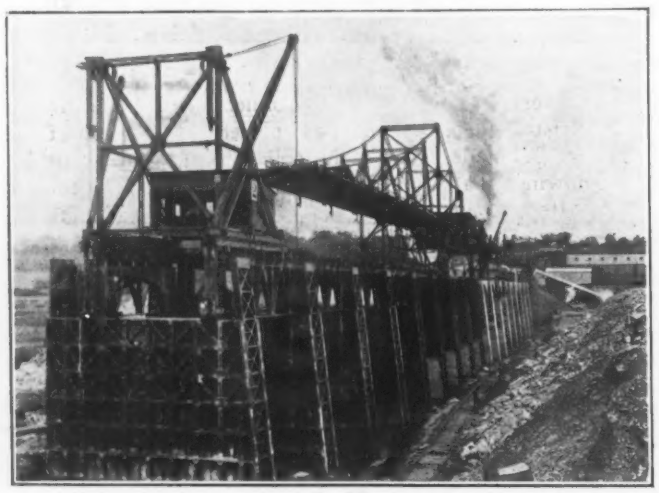


Fig. 2—Traveler Crane Pouring Concrete on Illinois End of Dam.

Messrs. Hugh L. Cooper and Charles F. Wallace; treasurer, Mr. Henry B. Sawyer; secretary, Mr. Clement R. Ford. Mr. Hugh L. Cooper is chief engineer of the company and is in general charge of the work at Keokuk.

NEW TURBINE STATION FOR LACLEDE GAS COMPANY, ST. LOUIS.

The Laclede Gas Company, St. Louis, which has 2600 electrical customers, is completing its new 9000-kw steam-turbine station at its North Side gas-making plant, the turbines to use boiler equipment in conjunction with the water-gas generators. For several years, since the destruction of its former power plant, the Laclede company has purchased its electrical energy from the Union Electric Light & Power Company.

The new station contains eight 500-kw boiler units, which will furnish steam jointly for the water-gas generators and turbine plant. Four of these boilers are equipped with chain grates and four with inclined grates and all are arranged with superheaters. The boiler-room is surmounted by four steel stacks, 110 ft. in height. One 1000-kw and two 4000-kw horizontal Curtis steam-turbine sets are installed, driving 2300-volt, 60-cycle alternators. For supplying 500-volt direct-current energy to the Laclede company's power circuit, to which a number of elevator motors are connected, a pair of 500-kw synchronous motor-generator sets have been provided in the engine-room. These machines, together with a 300-kw rotary converter driven by an exhaust-steam turbo-alternator at the gas company's South Side plant and a 500-kw motor-generator in an outlying substation on the west, will feed into the local 500-volt "power" network. The Worthington condensers for the turbines are supplied with Mississippi River water through a pair of 20-in. pipes now paralleled, and discharge into the river through a newly laid 30-in. main. Boiler-feed water is obtained from the city supply. The switchboard for the station is mounted on an overhead gallery, carried by the concrete oil-switch and busbar structure. Mr. George B. Evans is chief engineer for the Laclede Gas Company and Mr. William Gallaher is electrical superintendent.

ADDITIONAL LARGE BOILER AND TURBINE UNITS IN DETROIT'S DELRAY STATION.

The third 14,000-kw vertical steam-turbine set has just been placed in service in the new addition to the Delray generating station of the Detroit Edison Illuminating Company. Further extensions to the capacity of this plant will then be made by replacing the original installation of five 3000-kw turbo-units with 8000-kw sets. The Delray plant is located on the shore of the Detroit River several miles below the city, where it was originally placed with an idea to utilizing its exhaust steam for evaporating the salt brine mined in this locality, but with the advent of high condensing turbine efficiencies this plan has never been carried out. The output of the station, as three-phase, 60-cycle energy, is transmitted to the several substations at 20,000 volts through underground cables, several trunk lines of which are each 7 miles in length.

The Detroit Edison Company has recently attracted particular interest by its use of very large steam boilers. Several of these nominal 2300-hp units have, on test, been carried to steam outputs of nearly 8000 kw each, and a pair of the boilers show no difficulty in furnishing steam to a fully loaded 14,000-kw turbine set. The design of the boilers and settings for these 2300-hp units, several additional batteries of which have just been installed at Delray, was worked out by Mr. Alex. Dow, president and general manager of the Detroit company, in conjunction with the representatives of the manufacturers and engineers, and some recent tests of these huge boilers are said to have divulged such surprising results of efficiency and output that the investigators rechecked their instru-

ments and repeated the tests with the same results. The conclusions reached by a study of these boilers are promised in a paper to be read before the American Society of Mechanical Engineers this fall by Dr. Jacobi.

PRACTICAL DEVICES FOR SAVING LABOR IN THE OPERATION OF STEAM TURBINES.

By L. B. WEBSTER.

In the modern power plant the change from the reciprocating engine to the high-speed condensing turbine has resulted in greatly reducing the quantity of oiling, cleaning and wiping necessary in the engine-room. The reason, of course, is the absence on the turbine of most of the bright work and small rapidly moving parts found on reciprocating engines. In many plants, however, the substitution of the turbine for the engine has not resulted in any reduction of the engine-room working force, which most engineers would suppose to be the natural consequence of reducing the quantity of working parts to be cared for.

The reason for keeping more men in the engine-room than actually necessary to do the routine work is because the auxiliaries of the turbine must be constantly watched to prevent any shut-down by them for a period long enough to cause a stoppage of the turbine itself. A removal of the pressure from the oil step bearing or a filling of the surface condenser so that the condensed water is carried over into the air pump causes such serious damage that engineers, as a rule, feel that they cannot take chances by letting the turbine's auxiliaries go unattended for any great length of time. Such auxiliaries as the oil pumps or the wet-vacuum pump are often tucked away in corners where their movements cannot be readily observed. Unless an oiler pays special attention to them he cannot tell in his trips around the engine-room if they are working properly or not.

The accompanying sketches show how the engineers in some modern turbine plants have dealt with the problem of being able to tell just what the various troublesome auxiliaries are doing and how they are working, without going to the expense of keeping a man constantly on watch over them.

Fig. 1 shows an accumulator, which keeps constant pressure in the oil step bearing, connected to the spare oil pump. By means of a weight *A*, attached to a cord *B*, which is run over a pulley *C*, and wound around a spool *D*, which in turn operates the steam inlet valve of the extra

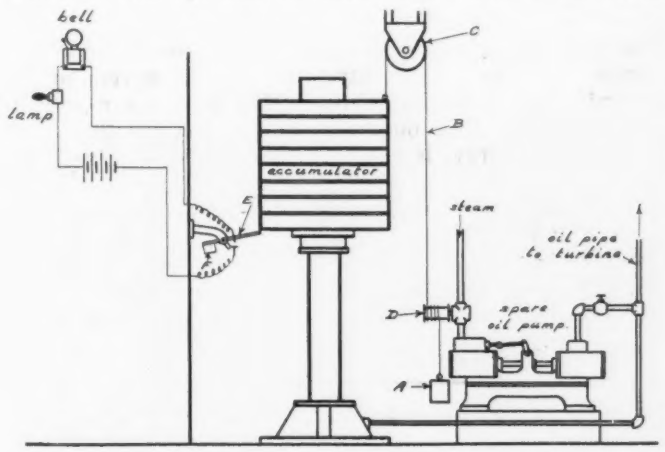


Fig. 1—Arrangement of Accumulator for Constant Oil Pressure.

pump, this extra pump is thrown into service whenever the failure of the regular pump to maintain sufficient pressure allows the accumulator to fall. In order to notify the engineer on duty whenever the accumulator falls enough to throw the extra pump into service, an electric circuit, containing a bell and a red lamp, is closed by the accumulator itself pressing down on a wooden strip *E*. To this strip *E* is fastened a counterweight *F*, so as

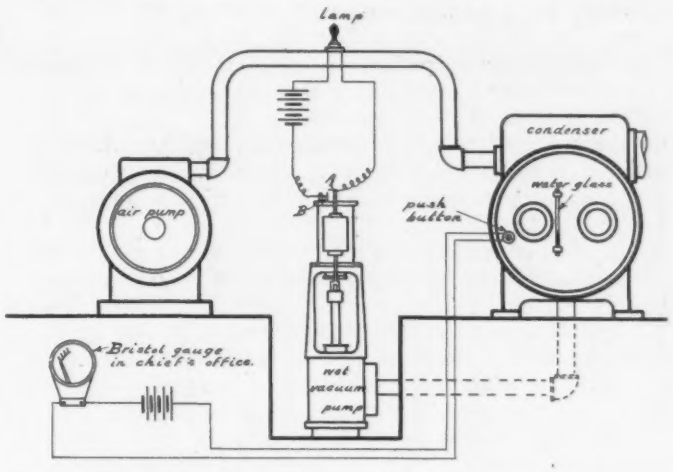


Fig. 2—Arrangement for Checking the Quantity of Condensed Water in a Condenser.

to prevent a contact being made until the accumulator has fallen a certain predetermined amount.

Fig. 2 shows a vertical-lift, wet-vacuum pump, which at times would stick and allow the condensed water to rise too high in the condenser, thereby endangering the air pump. A red lamp on a suitable electric circuit was made to flash intermittently by attaching one side of the circuit to a contact point *A*, which was fastened to an extension of the slide valve and moved up and down with it, and the other side to a strip of copper *B* so fixed that the contact point would rub across it twice during each complete stroke of the pump. Whenever the lamp either failed to burn at all or else burned continuously, the engineer knew the pump had stopped working. As long as the lamp kept up a regular flickering the engineer on duty knew that everything was all right.

In another plant, where the same danger of the condensed water in the condenser rising high enough to be pulled over into the air pump was present, a watchman's time detector in the shape of an old Bristol gage was rigged up as shown in Fig. 2. By calculation and test it was found that under ordinary load conditions the quantity of condensed water which could collect in fifteen minutes would not be sufficient to fill the condenser high enough so that the water could be drawn over into the air pump. A push button was placed beside the water glass on the condenser and the oiler on duty was instructed to press it every fifteen minutes. Connecting this button with the Bristol gage, which was placed in the chief engineer's office, made possible the collection of permanent records showing that the oilers had inspected the condenser as often and as regularly as required to insure the safety of the apparatus.

ELECTRICAL OPERATION OF QUARRY AND STONE-CRUSHING PLANT.

Mr. George Patnoe, general superintendent of the Dolese & Shepard Company, which has a large electrically equipped limestone quarry and stone-crushing plant at Gary, Ill., addressed the Electric Club of Chicago on July 19 on "The Use of Electrical Energy in Stone Crushing and Quarrying." The plant described is a new one, and Mr. Patnoe took up the various applications of electricity in it. In relation to the drilling of the rock for blasting experiments have shown that electrically driven well drills will do 25

per cent more work than steam drills at 50 per cent of the cost. Experience at this quarry has demonstrated that electric drills are a great success.

After the rock is blasted out it is transferred to the crushing plant by means of semi-automatic electric tramways. Twenty-five cars are used on several lines of tramways and they are operated by two men in signal towers. These cars have a maximum carrying capacity of 40,000 lb. each. It would take at least seven steam locomotives to do the work of this electric tramway system, which has proved very efficient. The cars are individually equipped and are not operated in trains, thus insuring more uniform feeding of the crushers.

The rock is dumped into a crusher at the rate of 15 tons a minute. All the machinery used about the plant is electrically driven, the motors ranging in size from 5 hp to 300 hp. It is important in stone-quarry operation by electricity to allow a liberal margin in selecting the size of the motors. To wash the crushed stone intended for use in concrete a plant has been installed. This washing plant is a recent adjunct and the flexibility of electric drive is conspicuously illustrated by it, as the power requirements for the new plant are easily taken care of.

Electrical energy is purchased from the Economy Light & Power Company, of Joliet. The operating cost for electrical energy is about the same as for steam operation, being 3⅝ cents to 3¾ cents a cubic yard of crushed stone produced. This figure includes all power-operating costs except for the steam shovel which is used. However, the electric drive has manifest advantages over steam operation in enabling labor to be used more economically in case it is desired to shut down a portion of the plant. When this is considered, and also the interest and depreciation on the steam plant displaced, the cost of electrical energy for operating the establishment is really less than the corresponding cost using steam engines. Mr. James H. Delany presided at the meeting, and Messrs. John W. Mabbs and C. W. PenDell also took part in the discussion.

IMPROVING A BELT LINE.

By W. H. Wakeman.

Fig. 1 illustrates a belt drive which was installed in a certain shop several years ago and has proved satisfactory ever since, so far as the machinery is concerned, but owing to local conditions a change is now desired. The flywheel of an engine is shown at 2, which is belted to the main pulley on a jack shaft, 3. Near the other end of this shaft there is a larger pulley which drives a dynamo, 4. Between these two pulleys a smaller one is located, and this drives 5, which is on a long main-line shaft extending down through the shop.

The objections to this drive are as follows: The jack shaft 3 occupies floor space that is now required for other purposes. While it is high enough for a man to walk under, still it renders the floor space under it practically useless, and indirectly it interferes with the use of floor space beyond it. The horizontal belt extending to 5 is also objectionable. Taking these two features into consideration, a comparatively large amount of floor space is rendered useless. The pulley 5 includes a clutch, and therefore it is possible to stop the line shaft at pleasure so far as this feature is concerned. But two other departments are driven from this shaft, and if power is not wanted in these, either one may be stopped by means of a clutch, which is not shown; while this is satisfactory, if power is wanted in one department, 5 must be run to supply it.

The main-line shaft which carries 5 also carries 56 other pulleys and belts. As power is not wanted every hour in this department, the manager wishes to shut it down at times, but cannot do so because power is required in one or both of the departments beyond this, which would be stopped if the clutch at 5 was pulled out. One of these is to be operated by electricity at some future time, which disposes of that part of the problem, and an improved plan for driving the other will be explained below.

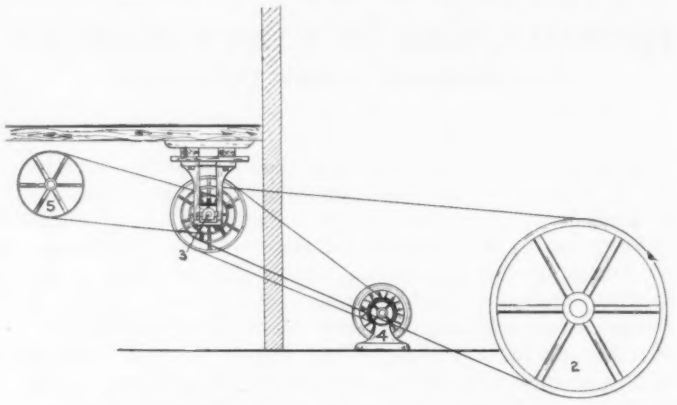


Fig. 1—Belt Drive with Jack Shaft Located at Ceiling.

Fig. 2 shows the same flywheel 2, but the jack shaft 3 is now located in the basement, where it occupies room that cannot be utilized for other purposes, leaving the floor space above entirely clear. The dynamo 4 is driven practically the same as before, and 5 is operated by a vertical belt which occupies but little floor space, especially as it runs near one of the large posts which support the floor above. It can be boxed in and rendered noiseless.

Another belt is laid on top of the driver of 5 and extends to 6, thus turning shafting in the department above. The idlers 7 and 8 guide these belts and hold them in place. Bearing in mind that both 5 and 6 are clutch pulleys, it will be seen that either department may be stopped at pleasure without interfering with the other. There are always objections to a vertical belt, but they do not apply in this case, because the same belt that runs vertically also runs nearly horizontally, forming what may properly be called an "angle belt"; hence, it can be operated in a loose condition and still transmit the required power. Belts that are to be used under these conditions should always be made endless, as any kind of lacing is objectionable.

The hangers which support the jack shaft 3 in Fig. 1 are also used in Fig. 2, but they are reversed or converted

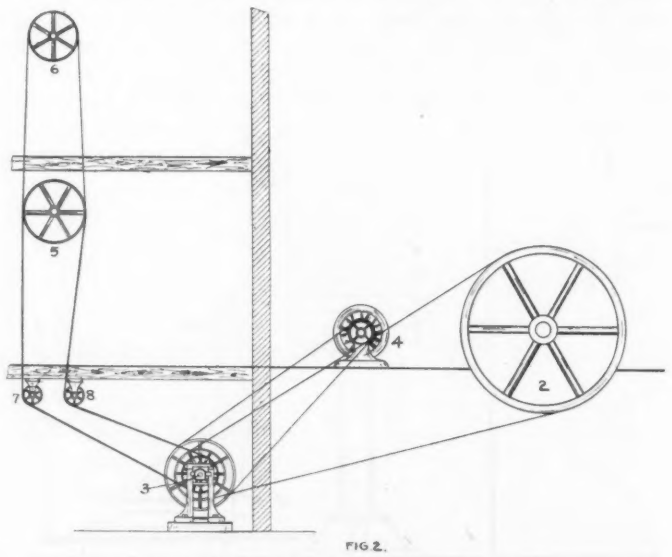


Fig. 2—Jack Shaft Located in Basement.

into floor stands. The boxes are changed in order to keep the slots on the upper side when the hangers are turned over. These hangers might have been hung to the floor timbers directly over their present position, but this would bring the main belt too high.

LETTERS ON PRACTICAL SUBJECTS

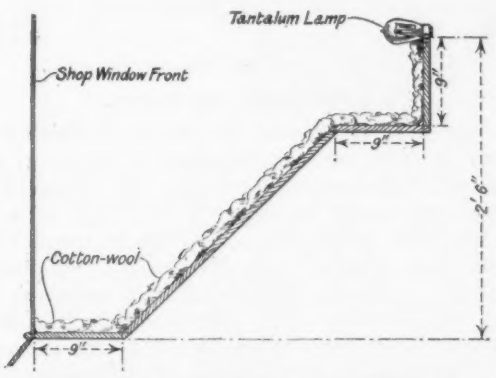
COUNTING SHAFT REVOLUTIONS.

When one wishes to know the speed of a revolving shaft and no speed indicator or tachometer is at hand, the number of revolutions may be found by holding the finger or a pencil against a key-seated portion of the shaft and counting the number of times the keyway passes under the finger. This familiar method is good enough for speeds below 200 r.p.m., but when the speed is greater than this it is still possible to count the revolutions by considering the blows of the keyway against the finger as occurring in groups of two or three, and counting only every second or third blow. By counting in triplets and multiplying the result by three speeds considerably higher than 500 r.p.m. may be ascertained with little difficulty.

Newport, Ky. EDWIN C. WRIGHT.

DANGER OF BROKEN LAMP NEAR INFLAMMABLE MATERIAL.

The accompanying illustration shows a diagram of a show window lighted by tantalum lamps, the breaking of one of which caused a fire resulting in loss both of life and property. Two shelves were joined together by a sloping board surmounted by a vertical board 9 in. high. All the shelves and boards were covered with cotton wool upon which were displayed celluloid combs, jewelry, etc. On the top of the vertical 9-in. board were clamped lamp holders arranged so that the lamps would be at right angles to the board and projecting over it into the window. Where the lamps projected the cotton wool was cut away in a circle. There were in all about twenty 16-cp tantalum lamps connected two in series across a 240-volt circuit by means of flexible wire. The lamps were spaced about 1.25 ft. between centers. While reaching into the window containing the lighted lamps a clerk is supposed to have broken one of the lamps and the hot filament ignited the cotton and celluloid and within a minute the whole window was ablaze. As to the actual cause there appears to have been some doubt, but experiments conducted subsequently showed that the supposition was tenable and that incandescent lamps installed under the conditions mentioned are a source of danger. In one experiment a lamp was suspended a distance of 3 in. over dried cotton wool and the bulb broken by a hammer. The broken filament instantly ignited the cotton wool and no fuses were blown. In another experiment a lamp was suspended 3 in. above cotton wool thinned out on which rested a celluloid telephone mouthpiece. On



Dangerous Show-Window Arrangement.

breaking the lamp both the wool and the celluloid immediately caught fire. The incident shows the danger of bringing flimsy decorative material near lamps, especially in unventilated windows where the heat ordinarily would cause the material to dry thoroughly and make it more of a menace than one would suppose. The Underwriters have ruled against flexible cord in show windows, and if the installation had been made in accordance with the rules it is safe to say no fire would have resulted. Persons are too prone, however, to underestimate the amount of heat given off by an incandescent lamp, some going so far as to imagine that the heat is negligible. If such persons would step inside the ordinary show window which is lighted by lamps placed in reflectors over the window and closed at the rear they would be instantly convinced of the fact that incandescent lamps give off considerable heat.

Toronto, Can. I. CLYDE.

TRANSFORMER MOUNTING FOR MILL SERVICE.

The accompanying illustration shows the mounting of two transformers arranged to supply energy to 220-volt,

250-kw Transformers.

three-phase motors having an aggregate rating of 110 hp. The motors are installed in a grain elevator and used in connection with corn shellers and feed mills. They range in rating from 5 hp to 25 hp. The energy is supplied from the mains of the Denison Light & Power Company, of which Mr. W. A. Everett is secretary and general manager. The wiring is in conduit and the job was installed by the lighting company. The poles are 35 ft. high with primaries on top on double cross-arms. The transformer platform is 15 ft. from the ground and is made of two pieces of angle iron with pieces of 2-in. x 12-in. boards placed on top. The second set or lower cross-arms are about 6 ft. above the transformers and one side is reserved for the primaries and the other side for the secondaries, with fuse blocks for the primaries at the left-hand end. The primary circuits consist of No. 6 wire, and the secondary circuits are made up of 500,000-circ. mil cable. Altogether the job has proved very satisfactory and constitutes a means for mounting transformers not often used.

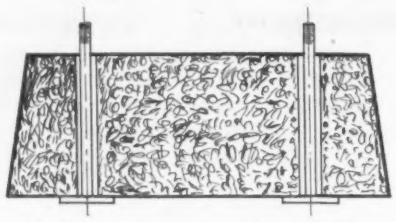
Denison, Tex. O. P. SAMMONS.

METHOD OF SETTING FOUNDATION BOLTS.

It is often convenient to have a little adjustment to foundation bolts, as where the fit is close it is apt to be difficult to get a machine in place. This end can be accomplished by placing tin tubes around the outside of the bolts, as shown in the accompanying illustration, the tubes being about twice the diameter of the bolts. The bolts are held in place while building the foundation by a wooden template. After the foundation has set and the template has been removed the foundation bolts have a lateral movement in any direction equal to the difference in diameters between the bolts and the inclosing tubes.

When it is desired to bolt a piece of machinery to an old foundation it is usual to drill holes in the foundation

for the bolts and fasten them in with melted lead, sulphur or cement. To avoid the trouble of building an accurate template the bolts should be about 1 in. too long and the machine itself used for the template. The foundation bolts are put in the holes drilled for them and the machine then



Method of Setting Foundation Bolts.

set in place, keeping it about 2 in. off the foundation with some strips of board. A tin trough that will go between the base of the machine and the foundation is then used in pouring the lead or other material into the bolt holes. After the lead has set around the bolts the machine can be let down on the foundation and if it is found that the bolts stick up too far they can be cut off with a hack saw.

Kenyon, Pa. F. M. Nichols.

A PECULIAR CRANE-MOTOR ACCIDENT.

A rather unusual accident has twice occurred to a crane motor in a large shipbuilding plant not far from Boston. This motor is rated at 45 hp, being the bridge motor on one of the largest gantry cranes in the country. The crane moves along a 500 x 150 ft. wharf, straddling practically the whole width. The motor stands on a small platform near where the rear legs join the main bridge and drives one wheel on each rail by means of shafting extending down the legs, fitted with bevel gears. One of the main features of this crane is an 80-ft. boom which can be lowered to a horizontal position and is used to place material aboard ships lying at the dock. This boom, together with all the top-work of a structure that can handle 80 tons or more at a load, makes up a surface which offers considerable resistance to the wind. On a morning when a heavy gale was blowing down the wharf the crane, when moving in the same direction, blew out fuses and circuit-breaker and came to a sudden stop. Investigation showed the banding wire on the motor armature broken and the windings spread and badly torn. So tightly was the armature wedged against the pole-pieces that it had to be driven out. The wind had not only relieved it of all load, but had probably actually aided its rotation. Several months later, during a storm coming from the opposite direction, this accident was repeated. No break is employed on the bridge drive. While any series motor might, perhaps, be apt to do this if run without load, in this case the type of motor contributed largely to the accident. This motor is of standard make and of the iron-clad type quite generally employed on cranes in the smaller sizes, but is not of the railway model ordinarily furnished for heavy work. The armature diameter is too large for any speed above 950 r.p.m., and the ratio of the gearing had evidently been designed for a very easy drive under all conditions.

Taunton, Mass. R. P. Irving.

REPAIRING FAULTY CABLE BY MEANS OF A TRANSFORMER.

A small intercommunicating telephone installation gave considerable trouble, and an investigation and test with a Wheatstone bridge indicated very plainly that the trouble lay in the cable connecting the various telephones. The test showed the insulation resistance between the various wires to be quite low, and a careful examination led to the conclusion that moisture had accumulated in the cable. The cable consisted of No. 18 wires covered with double cotton and paraffine—the ordinary annunciator wire. These wires were laid together and the whole covered with a thick braid of cotton, also thoroughly paraffined. It was the kind of cable used several years ago for small telephone installations and annunciator systems. As it had been installed while the building was being erected, it was impossible to remove it from the walls, and it would have caused considerable trouble and damage to the building to have installed a new cable, so an attempt was made to dry out with hot paraffine the accessible portions of the cable, especially at the outlets where the end of the cable was exposed. This was only partially successful, for, while some of the wires were cleared, still a number remained crossed, and the insulation resistance of all of them was too low to promise continued service. It was, therefore, decided to dry out the cable by means of electricity passed through it. It was feared that energy at lighting potential would be unsafe on account of the liability of 110 volts to puncture the damp cable where it came in contact with grounded metal—portions of the cable running through steel conduit. It was decided to use the ordinary lighting current and to reduce it from 230 volts to 23 volts. A 3-kw transformer was used, being the only one available. A larger size would have been preferable, as the resistance of the secondary winding, together with the resistance of the wires in the cable, held the current down to a rather low value. No alternating-current voltmeter reading such a low voltage could be obtained, so the voltage was tested by the means of several miniature lamps, such as are used in flash-light batteries and series Christmas-tree outfits. These lamps of different voltage enabled rough determination of the voltage to be made. The current was determined by inserting fuses in the circuit, beginning with a small fuse and gradually increasing the size of the fuse until one was reached which did not blow. It was found that something like 10 amp was the heaviest current which could be sent through the cable. Two wires of the cable were connected to the transformer, then the ends of these wires at the far end of the cable were twisted together—it being easy to select them by means of the spark. Several thermometers covered with wrappings to prevent loss of heat were placed on the cable in its exposed parts. In the course of about forty-five minutes the temperature would reach a maximum varying from 50 deg. C to 60 deg. C., the temperature of the air being about 20 deg. C. The transformer was then removed, the wires untwisted and tested. This treatment was repeated on each pair of wires. After treating all the wires in the cable a test showed them to be entirely free from leakage. A larger transformer and a higher temperature would have been quicker and probably better, and it would seem entirely possible to raise the temperature sufficiently high to melt the paraffine or other insulation and thus repair an actual break in the insulation, should such exist.

Staunton, Va. P. N. Trout.

A SAFETY PANEL FOR CRANES.

In an endeavor to prevent the accidents which continually occur through careless handling of cranes in a large mill the following control panel has been designed to replace the usual panel furnished in the cage of a bridge crane. The new panels have not been in use a sufficient length of time to prove that they will accomplish their purpose without failure, but there is every reason to believe that they will do so to a very great extent. It is intended to prevent such accidents as are caused by the operation of the cranes by unauthorized persons, by the unintentional or accidental manipulation of a controller while some person is working on or about the crane under the impression that it will not be operated, by a "dead" supply becoming "alive" while a controller may be in an "on" position with no one in the cage, and by various other unexpected conditions. It is almost beyond belief that such accidents as do

occur can happen at all, and it has become absolutely necessary not to rely on the operator or others whose duties require them to be about the cranes if it can be avoided. Fig. 1 is a diagram of the connections of the panel and Fig. 2 a front view of the panel as mounted in its box in

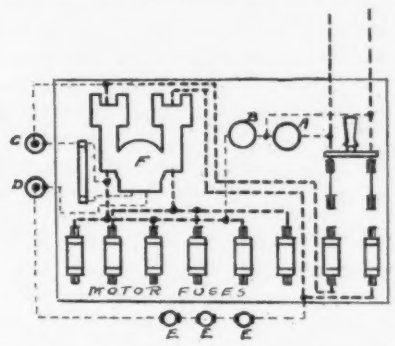


Fig. 1—Diagram of Connections.

the crane cage. The main service switch is provided principally to satisfy the insurance requirements, and as it is present it has been considered advisable to provide the opening in the panel-box door, through which it may be operated, as an additional means of opening the main circuit in case of emergency. All ordinary main-line control is by the push buttons *C* and *D* operating the magnetic switch *F*, *C* being used to close and *D* to open the switch, as indicated in the diagram. It will be seen that the operating coil of this switch is so connected that when the switch is open the coil circuit is open. As the switch is held closed by the energized coil, any break in the coil circuit or failure of voltage therein will allow the switch to open. As long as there is no voltage in the main circuit the switch will remain inoperative, but if the main circuit is alive the switch may be closed by pushing button *C*, which shunts the break due to the switch being open. Button *D* being pushed opens the coil circuit and allows the switch to open. If any of the safety plugs *E* be removed the switch must remain open until they are returned, as their absence opens the circuit and the switch cannot be operated. The object of the plugs *E* is that anyone having one of these plugs in his possession may be assured that the crane is inoperative until he replaces it. The lamp *A* indicates by its incandescence that the trolleys are alive, and the lamp *B* indicates in like manner that the panel is alive on the load side of the magnetic switch. Fig. 2 illustrates the appearance of the completed panel box as mounted in the crane cage. The box is of sheet

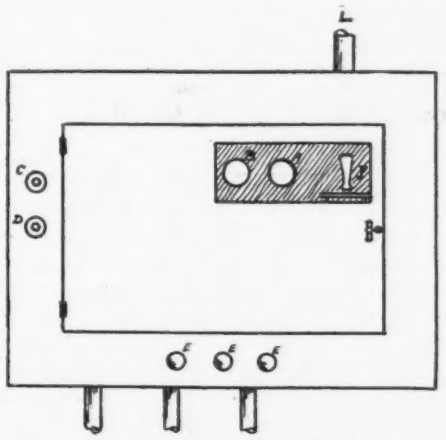


Fig. 2—Front View of Panel.

steel following standard panel-box construction with the exception of depth, which is made great enough to accommodate the magnetic switch. The door is locked and control of this magnetic switch is had by the push buttons before mentioned, which are mounted at one side of the door. The window in the door is designed to allow the indicating lamps to be seen and the handle of the service switch to be reached. Other parts of the panel are inaccessible to any one but the electrician who carries the key. The three plugs *E* have a round-knob head painted bright red and on the door above, with an arrow pointing to them, is a notice directing any person working on the crane to remove and keep in his possession one of these plugs until his work is completed and he is leaving the crane, and all employees whose work brings them on or about the cranes are personally instructed to the same effect. Three plugs are considered sufficient, but, of course, more can be added if thought necessary. Suppose that an electrician and a machinist are sent to work on a crane, the crane runway or some other apparatus where the crane might interfere with them. One arrives and removes a plug, puts it in his pocket and goes to work. Soon the other arrives and in turn takes possession of another plug. At the completion of his work each one replaces his plug. From the time the first plug is removed until the last is replaced the crane cannot be operated. In this way it is hoped in the future to avoid accidents due to carelessness and definitely to place the responsibility for any such as may occur.

Waterbury, Conn. F. L. THORNE.

INDUCTION MOTOR SLIP.

Irrespective of the name and nature of the several emfs and counter emfs active in the circuit of an induction motor in operation, the fact remains that the motor runs because of an emf applied to the primary in producing a secondary current that reacts upon the primary field, thereby producing the attracting forces that cause rotation. In a direct-current motor the counter emf generated, as soon as the motion of the armature enables its conductors to cut the magnetic lines of the field, helps to limit the current flow, and at full speed is the only current-limiting agent aside from the negligible internal resistance of the machine, and the greater the counter emf the smaller the current flow. In this case the emf generated in the armature rotor is due to conductors cutting lines of force. In the case of the rotation of the rotor secondary of an induction motor, instead of conceiving rotation to be due to the rotating magnetism of a stationary field structure, it is easier, for present purposes, to conceive the rotation to be due to the magnetism of a field structure separately excited and rotating at synchronous speed. In other words, conceive the rotor and stator to have independent bearings and the stator to be belted to an outside driving source able to rotate it around the rotor. When the stator with its defined poles is rotated its magnetism cuts the rotor conductors and in them generates an emf and hence produces current that reacts upon the moving field of the rotating stator. The result of this reaction is that the rotor too begins to rotate and soon acquires a speed almost equal to that of the belt-driven stator. The difference between the rotor speed and stator synchronous speed at any time is called the *slip*, and the greater the mechanical load, hence drag, placed on the rotor the greater will be its slip.

As most of the interesting induction motor facts rest in mathematical seclusion, many have obtained the wrong impression once held of the counter emf of a direct-current motor, namely, an unavoidable feature that might well be eliminated; but a direct-current motor that could develop no counter emf could not start, because for every conductor tending to produce rotation in one direction there would be a similar conductor with equal tendency to produce rotation in the other. Moreover, slip is just as necessary to an induction motor as counter emf is to a direct-current motor, for it is the slip that enables the motor to take current according to the demand of the load. In an actual induction motor conditions are magnetically similar to those just outlined except that the cutting of the rotor conductors by the stator magnetism is due to

the magnetism rotating around the stator instead of the stator rotating bodily. In either case the emf set up in the rotor depends upon the speed with which the stator lines cut the rotor conductors, and this speed in turn depends upon the relative speeds of the rotating stator magnetism and the rotor rotated by it. In an induction motor with emf applied to primary winding on the stator and the rotor secondary stationary the speed of the rotating magnetism in r.p.m. is the frequency of the applied emf in complete alternations per minute divided by the number of poles, and the speed of the rotor is zero. Therefore, the slip, the rate at which magnetic lines of force cut the secondary rotor conductors and the resulting secondary emf are a maximum and, unless measures are taken to prevent it, the secondary current will also be a maximum. When the rotor begins to move, however, as it travels in the same direction as the rotating magnetism, the moving lines of force cannot cut the moving conductors as fast as they did the stationary ones, and hence the secondary emf and current decrease; if the rotor secondary conductors could ever reach the speed of the rotating magnetism and they would travel along together, the slip would be zero, there would be no cutting of lines of force and the secondary emf and current would become zero. Just so soon as this condition would obtain, if it could, the turning power would become zero (except for inertia), the rotor speed would decrease, thereby introducing slip, lines of force would once more cut rotor conductors and rotor current would flow and provide torque, and the slip would be just sufficient to admit the current required to support existing load conditions. It is thus seen that to have torque there must be slip. If the motor is operating at a load that is suddenly increased, the rotor speed is almost as suddenly checked, the slip thereby increased and more current is admitted to sustain the increased load.

The phenomenon of slip is therefore closely related to the automatic regulation of the difference in the speeds of the rotor and the rotating magnetic field, and without such slip the rotor secondary current would be nil.

Schenectady, N. Y. E. C. Parham.

SOME PROBLEMS INVOLVED IN REBUILDING A GENERATING STATION.

From time to time during the past two years descriptions have been given of the improvements made to the Colfax Avenue plant of the Indiana & Michigan Electric Company, at South Bend, Ind. The power house has been entirely rebuilt without stopping for a single day. At present further extensive improvements are well under way and excavations have been made for two very large smokestacks and for a mammoth hot well. The stacks are to be 225 ft. high and the flue opening will be 11 ft. in diameter at the top. Each stack is to be built of reinforced concrete. In addition to the smokestacks extensive condensing arrangements which are under way call for water to be brought from the St. Joseph River from 500 ft. and 600 ft. through a tunnel and discharged again into the river through another tunnel. The intake will be located about 100 ft. up stream from the discharging end of the tunnel. The tunnels are to be constructed of reinforced concrete tile, 3 ft. in diameter, made up in sections about 3.5 ft. long, the sections being molded upon a vacant lot close by. The regulation type of sewer pipe is used for these tunnel sections, which will be laid in an open cut from the hot well to the river, the bottom of the tunnel being nearly 20 ft. below the surface of the street. The river ends of these tunnels have presented several engineering problems. Double rows of interlocking sheet piling are driven about 12 ft. apart around that portion of the river bank where the tunnels enter and discharge. The space between the rows of piling will be puddled to prevent the ingress of water. The bottom of the tunnel will be about 12 ft. below low-water level and, as stated, about 20 ft. below the street surface. A pile driver placed upon a scow was used for driving the sheet piling. It chanced that the inlet tunnel was located just above the Colfax Avenue bridge, while the outlet tunnel came just below or to the north of the bridge. The pile-driver scow therefore was underneath the bridge nearly all the time, and to provide a supply of fuel the engineer rigged an ash chute underneath a hopper about 4 ft. in diameter, the hopper being attached to the hand rail of the sidewalk on the bridge, and some old 10-in. sheet-iron pipe was connected from the hopper to a point 4 ft. above the water line. Whenever coal was to be sent aboard the pile driver the scow would be warped beneath the ash chute and the coal dumped into the hopper on the bridge. At the site of the concrete stacks and the hot well some difficulties were encountered. At one point a water main broke and quickly transformed a stratum of fine material into first-class quicksand, through which tools and timber found their way like a hot wire through grease. Several additions of piling had to be driven to stop the flow of alluvial quicksand, but after the water pipe was repaired the trouble practically disappeared. About 8 ft. from the surface blue clay was encountered, which ran down through the rest of the excavation. The stacks will be built upon blue clay, which is worthless for pottery or brick-making purposes. It was necessary to excavate for the hot well to a depth of 21 ft. Necessarily, as the stack is adjacent to the hot well, its foundation had to be excavated to a similar depth. This necessitated an excavation over 100 ft. long by from 60 ft. to 80 ft. wide and 21 ft. in length. The nature of the soil was such that a very complex system of timbering had to be installed, and even when great strength and rigidity were given to the timbering the immense pressure at the outside corners of the clay nearly succeeded in forcing the sheet piling into the excavation. As the digging proceeded it was necessary to drive other piling inside the first, and complex timbering also extended to these lower levels of sheet piling. To handle the excavated material properly, and the concrete material as well, a large stiff-leg derrick was erected with a boom which commanded the entire area of the excavation. A great deal of ingenuity was exercised by the engineers in the construction of the stiff leg. For the foundation three large telegraph poles were utilized. They were formed together like the letter A. The hoisting apparatus was placed upon the crosswise portion of the A, the mast with its bull wheel was placed upon the apex and a heavy cob-house structure filled with earth was placed on either foot of the letter A. Two other poles were utilized to form the stiff-leg portion of this derrick. These poles were bolted to the feet of the A-frame in the midst of the cob-house construction noted above. The arrangement proved very simple and adequate, and evidently resulted in a saving on the cost of the installation of conventional derricks built of massive yellow pine timber. One of the derricks was erected at the site of each smokestack, and, while one was operated by the regulation two-drum hoisting engine, the other derrick was operated entirely by electric motors, two of which were installed, one of the railway type, with a regulation controller, being attached to a regulation two-drum hoist, and the other being attached by pulley direct to a small ordinary drum, around which a turn was given to the wire cable leading to and from the bull wheel. To move the derrick in one direction a double-pole switch above the bull-wheel motor was thrown in a certain direction, and the power of the motor was applied through a pulley and a friction clutch to move the winding drum which turned the bull wheel. When it is necessary to move the bull wheel in the opposite direction the switch is opened, the induction motor stopped and the switch closed in the opposite direction. This causes the motor to run in an opposite direction, thereby enabling the bull wheel to be revolved as desired.

South Bend, Ind. James F. Hobart.

QUESTIONS AND ANSWERS

Given an eight-pole, revolving-field alternator, if two adjacent poles were removed and the r.p.m. remained the same, the armature connections being undisturbed, would the frequency be changed? W. T. W.

When two of the eight poles of a revolving-field generator are removed and the other poles are not redistributed the frequency of the delivered emf will be the same as formerly. The only change will be that the delivered emf will be decreased by 25 per cent. The voltage regulation of the generator would also be poorer than formerly.

In changing over some old meters, the magnets were removed and small bases attached to them. The magnets were then remounted at right angles to their former position. What effect does this produce? E. C.

The object of such a change is to prevent the meters from running fast after being subjected to heavy overloads or short-circuits. With the magnets in their former position the stray flux produced by short-circuits tended to demagnetize the drag or braking magnets, causing the meter to register more than the true energy. By causing this stray flux to travel across instead of along the magnets this effect is minimized, hence the change in the disposition of the magnets.

What would be the objection to starting a 30-hp induction motor on full voltage?

Even if such a motor were thrown across the line without load the magnetic attraction and repulsion between conductors would tend to tear the ends of the coils out of place. Moreover, the starting currents would be so heavy that they would render service on any distribution system unsatisfactory, so much so that no central station would tolerate a motor starting under such conditions on its lines.

Is there any advantage to be derived in building two generating stations, each to relay the other, and dividing the load between both? O. C. D.

The trouble with such an arrangement is that neither station would carry sufficient load to give reasonable economy in operation. The relaying feature in case one station were disabled is the only point in favor of such a plan. It has been found by experience that a well-designed station suitably safeguarded against breakdown by accident to machinery and equipped with duplicate feeders will give almost uninterrupted service. Any interruptions occurring will be infrequent and short, and service can be restored in less time than full relief could be obtained from a second plant. About 98 per cent of service interruptions are due to causes extraneous to the station.

Is it a fact that the fumes from direct-connected gas-engine sets attack the insulating materials on the generator windings, thus causing trouble from groundings? F. M. J.

Opinions of this kind have been often expressed, but cases which have been investigated do not always confirm them. Surface creepage usually takes place from the commutator necks across the under side of the insulated ends of the coils to the armature core owing to the formation of a conducting surface. By heavily varnishing the commutator necks and the armature core the trouble may be remedied for a time or until the varnish cracks at the points where the coils leave the slots. Another remedy which is said to be efficacious is to break up the exposed under surfaces of the winding by insulating barriers so arranged as to prevent the formation of an unbroken layer of conducting deposit. The troubles are mainly confined to armatures of machines subject to chemically active fumes such as are met in alkali works, chemical works, gas works, etc.

In testing a piece of apparatus for breakdown in insulation, what size of apparatus is usually employed? For instance, suppose it was desired to test the insulation of a 75-kw transformer, would a 600-watt transformer wound for 100 volts primary and 4000 volts secondary be large enough to test the transformer mentioned, which is wound for 2000 volts primary and 200 volts secondary? S. W. H.

According to the standardization rules of the American Institute of Electrical Engineers a testing transformer should be of such size that its ratio of transformation does not vary more than 10 per cent when delivering the charging current required by the apparatus under test. This may be determined by short-circuiting the secondary or high-voltage winding of the testing transformer and supplying 0.1 of the primary voltage to the primary winding under this condition. The primary current that flows under this condition is the maximum which should be permitted in regular tests for insulation strength. It would seem that a 0.6-kw transformer should be large enough to test the insulation of the 75-kw transformer, unless the test is made at an exceptionally high emf.

In the accounts of the electrical equipment of the new steamship *Olympic*, it is stated that the energy is distributed over a single-wire system at 100 volts. Kindly explain this system. T. Y.

Two methods of wiring steamships are at present in vogue, single wire and double wire. In the former one conductor only is employed, the return lead being soldered to a brass screw which is tapped into the framework of the ship, thus making the hull of the ship itself the return circuit. The double-wire system is similar to that used in land practice, and is preferable to the single-wire plan, which is open to serious objections. With the single-wire system it is necessary oftentimes to double-wire the ship for a radius of from 15 ft. to 30 ft. from the compasses or else to wire the forward part of the ship from a line 30 ft. aft of the compasses on the double-wire system. The joints of the return leads cause trouble since electrolysis is apt to arise and the insulation of the single wire must be nearly doubled because the ship is virtually grounded at all times. In the case of a ship the size of the *Olympic* no doubt there is a considerable saving by employing the single-wire system, but the practice is a poor one.

Is there any objection to placing a twin-conductor, lead-covered cable in a fiber or iron conduit? It is proposed to run a number of iron ducts parallel to each other and in contact; and each duct will carry a twin-conductor, 2200-volt, single-phase cable. How can the size of transformers required to make a test for dielectric strength in underground cables be determined? It is common for us to take two ordinary transformers connected in series and subject a short length of twin conductor cable to 2000 volts pressure between the conductors and from the conductor to the sheath. How does the capacity of the cable affect the load on the test transformers? M. H.

No possible trouble could arise from installing twin-conductor cables according to the method outlined. The dielectric strength of underground cables can very conveniently be tested by means of two ordinary transformers connected in series, just as you have done. Probably your attention should be called to the fact that it is preferable to separate the transformer cases from each other and thoroughly insulate each case from the ground. It is customary in selecting the transformers to use units having a large rating in comparison with the volt-amperes taken by the cable. If, as you state, only a short length of cable is tested at any one time, the capacity current of the cable can safely be neglected. Where possible to do so it is best to increase the voltage impressed upon the cables slowly rather than to subject a cable instantaneously to the maximum emf or remove from the cable the maximum applied emf. A gradual increase in applied emf can be obtained by means of a motor-starting rheostat connected in the low-potential circuit of the transformer. This rheostat should be used just as one would use such a device when starting a shunt-wound motor.

Central Station
Management, Policies and Commercial Methods

BUTCHERS' MECHANICAL REFRIGERATION SAVES TRIMMING OF MEATS.

Motor-driven refrigeration for butchers' cooling boxes has many advantages over ice, since, as often pointed out in these columns, a lower temperature is attainable, the cold is dry and in many instances a substantial saving in cost is made by the use of mechanical refrigeration. Butchers who have had experience with both icing and refrigeration further declare that the saving in the trimming of meats which results from a dry, low temperature is actually enough to pay the cost of running the plant, disregarding all other savings. In the moist cold atmosphere present with ice meat blackens rapidly, and from 8 per cent to 10 per cent must be trimmed from it before it is fit to be brought out onto the counter for the customer's inspection. With the intense, dry cold of mechanical cooling there is practically no loss or necessity for trimming, and butchers having mechanical refrigeration often declare they could not afford to return to the use of ice, even if the latter were obtainable free of cost.

HYDROELECTRIC POWER IN UTE PASS, COLORADO.

Service has recently been inaugurated at Green Mountain Falls, Col., a rapidly growing summer resort near the head of the celebrated Ute Pass, by the completion of a small hydroelectric plant under the auspices of the Empire Water & Power Company. The installation illustrates the facility with which even a small power may be applied to the needs of a flourishing community. The company's plant is located on Crystal Creek at an altitude of 8750 ft. above sea level, and receives its water supply from the above stream through a steel-pipe line 8 in. in diameter, the head upon the single Pelton wheel employed being 490 ft. Energy is generated by a 150-kw, 2300-volt, three-phase, 60-cycle alternator direct-connected to the waterwheel. The pipe line is 1026 ft. long. The service includes street lighting by 60-watt tungsten lamps operated in multiple on a 110-volt circuit, the lamps being provided with radial-wave reflectors. The plant is about half a mile from the center of the town, and is at present supplying commercial and residential customers on the basis of a flat rate. The plant is about 15 miles from Colorado Springs, and was laid out under the direction of Messrs. E. L. Benton and George B. Tripp, of the Colorado Springs Light, Heat & Power Company.

CLEVELAND COMPANY OFFERS 10 PER CENT BONUS FOR HOUSE-WIRING CONTRACTS.

The Cleveland Electric Illuminating Company has now removed all of its solicitors from the work of securing house-wiring contracts, turning this function over to the contractors of the city, who are offered a bonus of 10 per cent on all wiring jobs in houses on the company's lines. The minimum bonus the company will pay is $5 and the maximum $10 per house. The same offer of reward will later be generally made to any person who secures house-wiring contracts, provided he secures the wiring of at least five houses, such an outsider not being paid, however, until he has turned in his fifth contract. This provision is designed to prevent owners or tenants collecting bonuses on their own houses. When an outsider obtains the contract the wiring contractor, of course, receives no bonus, but has his usual profit under the unit system of computing wiring costs specified by the Cleveland company. All employees of the illuminating company are excluded from the bonus award, but may receive $1 commission for service-connection contracts brought in by them. Under the new agreement thirty-six contractors in the city share in the distribution of house-wiring work.

The cost of wiring has also been reduced 15 per cent below the former Cleveland unit scale on all outlets in excess of the first ten. As before, the wiring contractor allows ten months for the payment of the wiring cost, although the illuminating company does not enter into this transaction. Where the newly wired house is on the company's distribution lines 15 per cent of the wiring-schedule cost is credited on the customer's future lighting bills as before. These recent changes in house-wiring schedules have been made the subject of "Illuminating Dialogues" in the company's display-advertising space in the local newspapers, wherein the gist of the house-wiring offer is tersely stated in catechism form. Mr. M. E. Turner is contract agent for the Cleveland Electric Illuminating Company and has been in charge of the unusual and successful wiring campaigns carried out in that city.

TURBINE OPERATION WITH REDUCED CONDENSER SURFACES AT ST. LOUIS.

The last of four 12,000-kw vertical steam-turbine units is now being installed in the Ashley Street station of the Union Electric Light & Power Company, St. Louis, bringing the total plant rating up to 68,000 kw, which classes it among the very large power stations of the country. These 12,000-kw units are mounted on 18-ft. centers, and represent the concentration of 48,000 kw of prime movers in a space only 70 ft. x 15 ft. in area, which for density of rating is probably unequaled in any other plant.

The Union company has just completed the installation of two smaller 4000-kw horizontal Curtis turbine-generators at Ashley Street, replacing its former 1500-kw vertical-type units. In the case of these machines, as for the 12,000-kw units which replace four 5000-kw sets formerly installed, the original condenser equipment has been retained and is worked successfully at a surface intensity more than twice that for which it was designed, 4 sq. ft. per kilowatt of rating. During seven months of the year this condenser equipment is found ample to carry the full rating of the machines, although during the summer, when the temperature of the Mississippi River circulation water mounts to 87 deg. and above, the output of the units is reduced by 10 per cent or 20 per cent at 28-in. vacuum. This reduction occurs during the summer period, of course, when the demand on the plant is least, and the saving in condenser investment and replacement has been considerable.

In addition to its turbine units the Ashley Street station contains 12,000 kw in vertical, cross-compound, engine-driven equipment. These reciprocating units may later be arranged to exhaust into low-pressure turbines as has been done at the Commerce Street station in Milwaukee. Through the installation of a 1000-kw motor-generator set at the St. Charles Street plant it has now been possible to

shut down the Lewis Street station, which will be operated only to carry the extreme peak of the winter load if necessary. Mr. John Hunter is chief engineer of steam plants for the Union Electric company, and Mr. S. B. Way is chief engineer of the electrical department.

FESTIVAL OF LIGHT AT DENVER, COL.

In connection with the visit of an editorial representative of this journal a Festival of Light was held in Denver, Col., on the evening of July 29. Through the co-operation of the daily press arrangements were made for the complimentary lighting of the entire business district, including street, interior, window, sign, billboard and outline illumination, between the hours of 8:30 p. m. and 9:30 p. m., with the object of displaying the facilities available to a staff of photographers located on the balcony of the Daniels & Fisher campanile at a height of 270 ft. above the street. The accompanying photographs show the illumination of the city as viewed from the campanile, the office building of the Denver Gas & Electric Light Company being outlined by lamps aggregating a total installation on both faces of the structure of 72,000 cp. Among other important buildings illuminated specially for the occasion were all the principal office buildings in the business area, the State Capitol, Court House, Auditorium, Princess and Isis Theaters, with the addition of practically all the mercantile establishments in the downtown district.

Widespread publicity given to the carnival led a crowd of many thousands of people to gather on the streets during the hour of the special illumination, and great interest was aroused in the display. Among the special features were the outline lighting of the campanile by temporary incandescent service, the use of searchlights at strategic points on roofs, and the burning of red and green fire on the tower and on the deck of a 3.5-ton electric truck occupied by personifications of the Evil One and his mother-in-law. The truck was lighted by 1200 cp in incandescent lamps, and from it were distributed pasteboard models of incandescent lamps giving data as to the amount of lighting connected in Denver. In some instances the cards were redeemable in money at the office of the Denver

Fig. 1—Denver by Night Showing Illumination of Denver Gas & Electric Light Company's Building.

Fig. 2—Denver Street Illumination Looking Down Sixteenth Street.

Post. It is estimated that over 2,000,000 cp in electric lamps was visible from the campanile during the display, a large part of which is in regular service every evening.

MOTOR-DRIVEN CRACKER FACTORY.

By R. B. Mateer.

With the idea of supplying the local demand for biscuits previously obtained from distant manufacturers, some merchants of Denver organized and established the "Merchants' Biscuit Company of Denver." An old structure, three stories in height, was purchased, an oven built, and

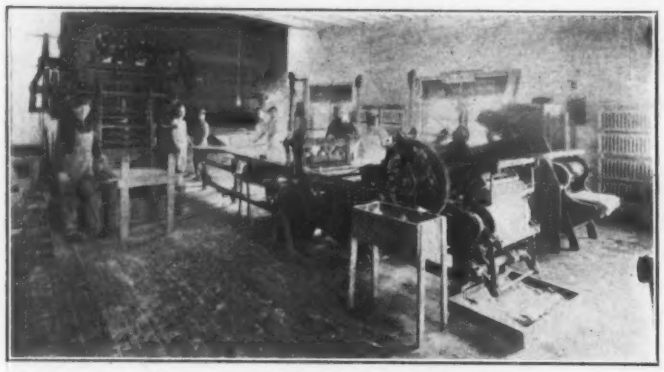


Fig. 1—View Showing Baking Oven and Cutting Machine.

dough mixers, rolling and cutting machines were installed, the machinery being operated by an electric motor. The energy was supplied by the Denver Gas & Electric Company at 220 volts, 60 cycles, three-phase.

Prosperity rewarded the effort made, and the plant has been enlarged to three times its original size. Wherever possible a polyphase motor was installed for the operation of each machine. There are now in use the following machines: An 1800-lb. dough mixer operated by a 10-hp, 1200-r.p.m. motor; a roll operated by a 5-hp, 1200-r.p.m. motor; a cutting machine operated by a 5-hp, 1800-r.p.m. motor. Silent chain drive instead of gear and pinion or belt is used for connecting the motor to the cutting machine. The huge new oven is of the rotary type, the wheel

Fig. 2—View Showing Conveyor and Collecting of Crackers.

being connected to a 3-hp, 1200-r.p.m. G. E. motor. The machinery above described is located on the fourth floor of the new structure and, with the exception of the motors, was built and installed by Thos. R. Green & Company, of Indianapolis, Ind.

On the third floor are the copper agitators and jam kettles, four icing mixers, a steam cooker, a fruit grinder and trolley, arranged for group drive and operated by a 10-hp motor. Two nailing machines made by the W. S. Doig Company, of Brooklyn, N. Y., are driven by a 5-hp, 1700-r.p.m motor. Two boxes per minute are assembled, stamped and sealed by means of this expeditious process. A modern conveyor and packing machine is operated by a 10-hp motor; a six-barrel mixer and one of two and a half-barrel capacity are operated by means of a 20-hp motor. Polyphase electric elevators, manufactured by Nock & Garside, of Denver, facilitate the rapid handling of both the raw and finished foodstuff.

The step from the old bakery to that of the modern sanitary type is no less remarkable than the change from steam drive to motor drive. The elimination of long line shafting and greasy belts by the installation of the individual drive, with either gear and pinion or silent chain, was possible only when the superior advantages of the electric motor were apparent to those interested in the baking industry.

HOW THE ELECTRICITY-USING HABIT GROWS.

A complaining customer sometimes comes into the lighting company's office and as proof that his last bill is too high exhibits the bill of a year before, declaring that he is "using no more electricity this year than last."

But the fact is that the average consumer, all unknown to

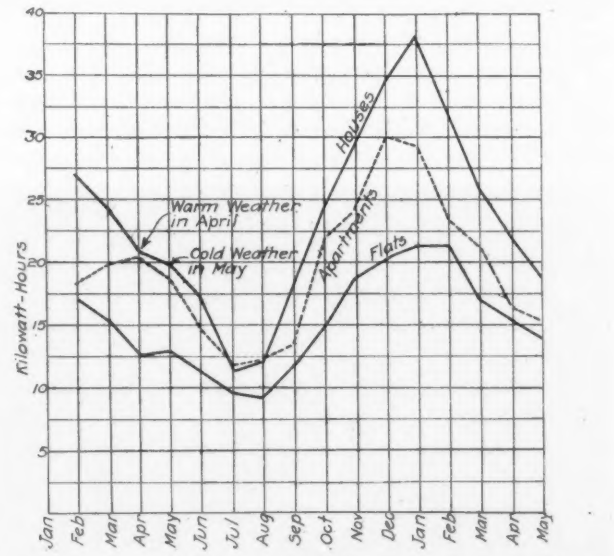


Fig. 1—Average Monthly Consumption of New Residence Customers.

himself, does actually use an increasing quantity of electricity from year to year as he discovers the many conveniences and comforts which central-station service affords. The new customer will consume more kw-hours the second year than the first, and this effect shows up in the increase of his monthly bill over that of a year before, to his own innocent surprise.

Some figures obtained by Mr. H. G. Kislingbury, statistician for the Union Electric Company, St. Louis, on the monthly variation of the consumption of residence customers of different classes afford some interesting sidelights on this growth of consumption during the first year. For classification purposes residence installations in St. Louis are divided among "houses," "apartments" and "flats." The apartments represent a better class of dwellings than the flats, which latter chiefly rent at rates less than $25 a month. The apartments are principally in large buildings in fashionable sections of the city. Fig. 1 shows the consumption

during a number of months of representative installations in these three classes. In each instance the data relate to new customers who had service installed during the preceding January, so that at the beginning of the record, in February, they had just got fairly launched in the use of electricity.

The curve for the house customers represents the average of sixty consumers, each installation having about twenty-five lamps. The second curve shows the average monthly consumption of forty apartment houses, each having an average connected load of seventeen lamps. The lowest curve is based upon the results from 100 flats, averaging fourteen lamps each. As already stated, all of these customers were connected up during January, and the billing periods for the various months have been carefully corrected so that they are representative of the month referred to.

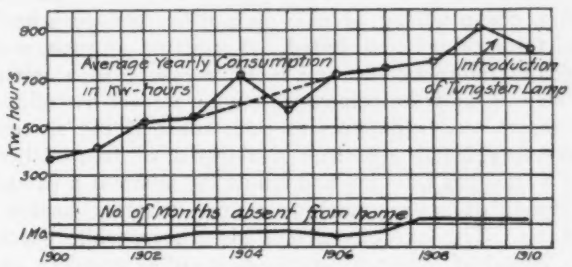


Fig. 2—Increase in Consumption by Average St. Louis Family.

Especially in the case of apartments and flats the curves show that the customers had learned to use much more electricity during the second February period than during the first month when new to electric service. The apartment-customer curve, as well as the monthly bills on which it is based, shows unmistakably how these good people had not learned the full advantages of electric service until the shortening days offset their increasing requirements for electricity.

The effect of a warm, early spring, followed by a cold spell in May, is also clearly reflected by the humps in all three curves for this spring period.

Fig. 2 shows the average kw-hours used each year by twenty St. Louis customers among the better class of residence consumers. The records of these twenty installations were available throughout the entire ten years, and with one or two exceptions the same families occupied the dwellings over the whole period. The customers' annual consumption, plotted as a curve, shows the increasing use of electricity until the banner year of 1909 brought the tungsten lamp into household use and consumption consequently decreased as indicated. At first it was thought that some difference in the mode of living of the people might have contributed to this increase of consumption, and an effort was made to find the length of time these customers were absent from home, traveling, etc. These results, plotted as a second curve, show, however, that the number of months spent in traveling has been increasing during the decade, so that the growth in consumption of electricity is, on a monthly basis, in fact, even slightly greater than the upper curve reveals.

EXCESSIVE INSURANCE RATES CHARGED ELECTRIC-LIGHTING STATIONS.

Central-station men have long entertained the idea that a modern electric-lighting station, with its contents, should be considered a preferable risk, but the insurance companies have always classified these properties as extra hazardous and have charged accordingly—some companies even going so far as to place them upon the prohibited list. That such properties have been wrongly classed by the insurance companies is evident from the returns received by Secretary D. L. Gaskill, of the Ohio Electric Light Association, from a number of Ohio central-station men and reported by him at the association's Cedar Point convention July 27.

In response to a circular inquiry sent to 150 Ohio plants sixty-one replied giving the various details asked concerning the amount of insurance carried upon buildings and machinery, the rates charged for such insurance, the amount of premiums paid in 1909, the losses incurred on buildings and machinery for each of the five years preceding the year 1910, whether protection was given from fire caused by electric current, the kind of buildings, kind of roofs, kind of fire protection, and whether stations were without attendance during any part of the day.

While it is to be regretted, reports Mr. Gaskill, that all of the Ohio central stations did not fill out and send back the blanks sent them, the replies so far as received were startling, and prove conclusively that the central-station men were correct in their claim that, instead of central stations being classed as extra-hazardous, they should have a class to themselves, with an AA1 rate, or one somewhat better than limestone under water.

The tabulated figures of the replies are as follows:

Amount of insurance carried on buildings reported	$380,853
Amount of insurance carried on machinery reported	982,577

Upon this insurance there was paid in 1909 $16,411 in premiums. The losses for the five years 1905 to 1909 reached the grand total of $60 in all the sixty-one stations reported. This occurred in one station and was caused by a tramp setting fire to a packing box outside of the station, burning out the window frames of two windows.

"The rates charged the different stations for fire protection have a wide range, running from eight-tenths of 1 per cent to 4 per cent per annum. Nineteen of the stations reporting carried no insurance at all, nearly all stating that the rates were so high that they preferred to carry their own risks. Thirty-two stations reported adequate fire protection and nearly all some protection. Eight stations out of the sixty-one are closed part of the day with no one in attendance; all of the rest have men in charge for the twenty-four hours.

"These figures are startling," repeats Secretary Gaskill. "Taking the amount paid in premiums in 1909, $16,411 (and it is safe to presume that for each of the years 1905 to 1908 as much was paid each year), this would make a total paid for the five years of $82,059, for which the companies returned to these central stations in payment of losses the sum of $60.

"Rates are entirely unequal, ranging from eight-tenths of 1 per cent to 4 per cent per annum, and seem to bear no relation to the kind of risk or its fire hazards. In one instance a frame building with a paper roof had the rate of 1 per cent, while in another a brick station with metal roof had a rate of 3 per cent. In one large city station with every fire protection known the rate is 4 per cent per annum, and this station reports that it never had a fire.

LIABILITY INSURANCE.

"Thirty-eight stations out of the sixty-one reported that they did not carry liability insurance. Ten stations reported the premiums paid by them in 1909 to aggregate $5,919. These ten stations reported losses in the past five years on employees, $255, on public liabilities, $5,225, the losses being confined largely to three of the stations reporting. Assuming that the amount paid in premiums by these ten stations in 1909 was the same as the amount paid for the four years previous would make the amount paid out by these ten stations in five years $29,595, with total aggregate losses, both public and on employees, of $5,450. This shows a very nice margin of profit to the companies on that class of insurance. The remaining number of the sixty-one companies reporting made no reply upon the liability insurance inquiries.

"It is very evident from the figures given in these replies and the totals in this report that insurance, both fire and liability, is being carried at entirely too high a rate and that insurance companies are using the bugaboo of electric current as a means of getting a high rate for the safest kind of service. In nearly every instance the companies reported that their policies did not cover loss on machinery from fire caused by electric current whether generated within or from natural causes without the station. This exception practically takes away all of the increased risk, if any exists, from electric current."

It was suggested at the last annual convention that the electric-light companies of Ohio might well organize their own insurance company on the mutual plan, as permitted by the laws of the State. Such a company, adds Secretary Gaskill, should have at least $500,000 of insurance and no risk should be taken at a greater sum than $3,000 on any one property. If such an amount could be procured there is no doubt that the company would be a success, and to the extent of $3,000 insurance, at least, on each station the costs would be materially reduced. In closing the author urged the association to have a committee appeal to the insurance companies for reclassification, as well as to investigate the possibility of a mutual company.

Mr. J. C. Martin, of Wilmington, Ohio, remarked that the power to amend present insurance rates lies within the electric companies themselves, and declared that unless a mutual insurance arrangement is insisted on the companies will continue to rob the central station by an unfair rate. Mr. E. A. Bechstein, of Sandusky, said that individual companies can usually effect an improvement by taking up the case with their own inspectors. The rate on the Sandusky station was reduced 30 per cent as the result of such a conference. Mr. Marden, of Springfield, said the greatest handicap was due to the incompetent character of the inspectors employed by the insurance companies.

PROMOTING CENTRAL-STATION BUSINESS IN A SMALL TOWN.

Considerable attention was attracted at the recent Michigan Electric Association convention by the paper on "Promotion of Business in Small Towns," prepared by Mr. George D. Slaymaker, of Rochester, Mich., and read in his absence by Mr. E. Coe, of Detroit. Mr. Slaymaker's paper was an unusual and accurate characterization of the conditions obtaining in small communities, such as his own place of 2000 inhabitants.

In towns of 5000 and less, wrote the author, the problem of the promotion of business must be faced sooner or later. "We of the small towns," he added, "have not the advantages of our city friends. We have not a growing city which taxes our facilities to the limit in merely keeping up with its natural growth. We have not a prosperous and progressive clientèle. Our problem is essentially different. We attempt to do business in a semi-rural community where the in-moving of a new family marks an epoch; where the population has a large proportion of farmers who have moved into town to die and small merchants doing a hand-to-mouth business; where an installation of twenty 16-cp lamps is considered the height of luxury, and where a small motor is rare or else unknown. A company operating in such a town, I say, inevitably reaches the point where it can see no more business ahead—all available residences and stores being lighted by electricity and there being no chance for a motor load because there are no industries. In such a case we are confronted by the alternative of standing still or else of making a new market for our commodity. The former alternative is untenable. Then how to accomplish the latter—the procuring of new business—is our problem."

Rochester's population of 2000 inhabitants is composed of retired farmers and small merchants. For industries there are one knitting mill, a small paper mill, a flour mill and two small machine shops.

The present lighting company entered the town a little more than a year ago, and at once began offering customers reliable twenty-four-hour service at low rates. These advances met with instant response in that practically all of the well-to-do householders wired up immediately and most of the stores scrapped their gas plants. It can be seen, however, that very soon the company would have been facing the problem of "standing still" or else "making its own market." Foreseeing this condition, the company has tried to forestall it and now hopes never to have to face it.

"In the first place," said Mr. Slaymaker, "our invariable policy of utmost liberality and fairness to customers won at once most of the available business. Free lamp renewals, prompt response to trouble calls, generosity in the matter of repairs, cheap wiring payable on a dollar-per-week basis—all of these things contributed. A solicitor, as such, is economically impracticable and is unnecessary in a town of this size. All of the company's employees act as solicitors. The meter reader inquires at each house if the service is satisfactory, leaves a flatiron on thirty days' free trial, suggests a washing machine and hands the mistress a pamphlet descriptive of sewing-machine motors, toasters, heaters or what not. The bookkeeper tells his grocer, while purchasing a pound of butter, about the new coffee grinders, or he explains to the butcher the advantages of tungsten lamps, or suggests a meat chopper. So we find our soliciting campaign is simplicity itself. Every one knows every one else. Every one knows every one else's business. Every one talks about one's neighbor. Consequently every employee of the company is ex officio a solicitor of new business.

"By these methods and in this way we soon had almost every house and store in town (where such expense was not prohibitory) using electricity not only for lighting but also for small motor service and appliances.

"Although our business increased and is still increasing handsomely, with a constantly improving load-factor, it was plainly seen that if we did nothing more than this the end was not far off. We would ultimately reach the standing-still stage, for the simple reason that there would be no more business to be acquired.

"Therefore we boom our towns. In the case of the town we are speaknig of we aided the start of a Board of Commerce for the purpose of attracting new industries. Practically all of the business men in town became members. An attractive pamphlet descriptive of our town was published and sent to all parts of the United States. Advertising matter was placed in newspapers. By means of clippings, prospects were found and closely followed up by correspondence. We solicited and received help and leads from similar organizations in neighboring cities and towns. Soon people began to hear about Rochester. Scarcely a week passes that we do not receive one or more inquiries from industries starting up or desiring a new location. Some we have declined; a great many have refused us. What matter? We are accomplishing our end just the same.

"And what does all this mean right here in town? It means that we have an enthusiastic body of men who believe in their town—a bunch of boosters in the place of discouraged knockers. We have a body of men every one of whom is a walking advertisement of our town. We have something before us all the time—matters to discuss—business to attend to. And the result is an awakened town.

"We offer no bonuses. We do not promise exemption from taxation. We do offer an ideal town for a good industry to locate in. And we believe this is enough. Business men are quick to see the advantages of a small town situated as is Rochester. Grafters don't see these advantages so readily.

"But what has all of this to do with the lighting company? Simply this. In a town of this size the lighting company is usually the only public-service corporation except the interurban street car company. Therefore, the lighting company, being in touch with the entire population, is the logical one to lead in such a move. By so doing we lay ourselves open to the criticism of self-interest. Well, if our motive is selfish it is not unworthy. What though we do count on increasing our business by the addition of new industries? Does not also every other merchant in town? Our company believes that everything which will benefit the town helps the company. To this end we freely furnish rooms where the board may hold its meetings and even allow our salesroom to be used for the demonstration of gasoline engines. At the present time the writer, as an officer of the Board of Commerce, is attempting to induce to come to town a concern manufacturing gasoline engines for the use of farmers, even though by so doing we warm a viper in our bosom. For we confess to a particular 'hankering' for that farmer business ourselves.

"In conclusion allow me to repeat:

"To obtain new business we make all employees solicitors and depend on low rates, fair treatment and invariable courtesy to do the rest.

"To obtain new industries we organize a Board of Commerce or a Board of Trade, advertise as extensively as possible, watch trade journals and newspapers for notices of prospects, and boost. And we see that the whole town is back of us and boosts too."

RATES FOR ELECTRIC SERVICE.

BY H. C. ABELL.

Assuming that a plant is built and a distribution system installed adequate for a certain period of time, as the plant and lines become loaded, the output curve becoming an average for an electrical plant, the expenses per unit sold will decrease until it becomes necessary to install additional apparatus and at the same time probably add to the working force, organization, etc., at which time the expenses may be somewhat increased, so that in the average plant the cost per unit sold may make a curve somewhat resembling a saw tooth, each tooth covering a period of from one year to four or five years. When the plant is large in proportion to the added increments of equipment and organization the total cost per unit sold is not so variable, unless it should become necessary to make some extensive investments, such as a large installation of underground distributing systems to replace an overhead system, a new generating plant or some large expenditure. In the case of the new plant the decreased output cost to generate by later and more efficient apparatus may partially offset the increased cost due to the increased investment.

When taking on large consumers whose demands would tie up fairly large percentages of the equipment it is essential to consider all the costs to the company, including the equipment necessary due to the proposed consumers' demand and load-factor.

The following will show some of the methods of analysis which were used in an actual case: A load curve was plotted which approximated that of the average electric plant. As the plant in question had a load approximating this, the actual load curve was used for the analysis. The expenses were obtained which were common to consumers only, the fixed expenses which were not common to consumers or varied with the output, which expense is usually called equipment, then the variable expense which was not a consumer expense and which is proportional to the energy sold, usually termed "output expense." To each of these three expenses are added the rate of return on the value of the property and the depreciation in proportion to the subdivision of expenses.

The following figures were obtained: Consumers' expense, $31,883.68; equipment expense, $36,458.91, and output expense, $74,633.54. There were 2900 average customers. The maximum demand for these customers was 1200 kw and the sales were 1,560,753 kw-hours per annum. The consumers' expense amounted to 91 cents per consumer per month; the average consumers' demand, relative to the maximum station demand, was 4/10 kw, which amounted to $1 per month, and the output cost per kw-hour sold was 4¾ cents. The consumers' active loads or demands were assumed as a percentage of the connected ratings varying with the various classes of consumers. (The writer will not go into these subdivisions, as they have been referred to in various articles in the *Electrical World* and under the headings of the reports of public service commission news for the different states.)

For this particular company the rates charged were 14 cents per kw-hour for the first thirty hours' use per month on the estimated demand of the connected load; 8½ cents for the next sixty hours' use, and 5 cents per kw-hour for all in excess of the first ninety hours' use per month. When reductions are to be made it is hoped that they will first come on the last step, then on the second step, until finally the actual rate will more closely approximate the average cost curve.

For comparative purposes the writer has taken the average of all classes of consumers which has been previously referred to. Curve "A" shows the price received per unit sold for a variable number of hours of use per day on monthly average by any consumer. It is based on the step system of 14 cents, 8½ cents and 5 cents and a demand of 4/10 kw. Curve "C" shows the amount of the consumer's monthly bill estimated on the various hours of use based on cost curve "A." Curve "B" shows the cost per unit for energy used during the month when assuming the same demand as curve "A." Curve "D" shows the consumer's monthly bill for the various hours of use per day based on cost curve "B." From these curves it can be seen that "B" crosses "A" at about two and three-quarters hours' daily use on the demand taken.

In the illustration which is taken in this article 84 per cent of the energy was sold during the first two hours per day on the demand, or less time. Curve "B" shows that energy sold to a consumer who uses less than an average of eighty hours per month, on the rates of curve "A," does not pay to the company his average cost, which includes interest and depreciation.

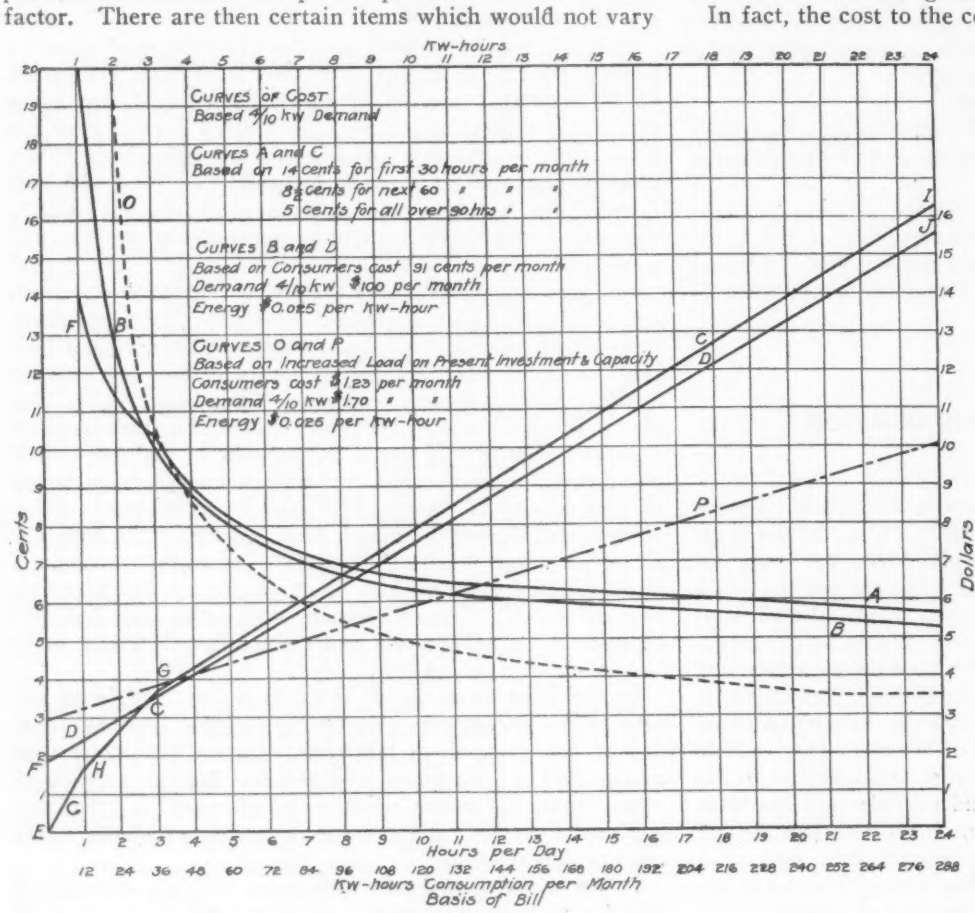
If the company had two consumers with the demand of 4/10 kw and one consumer used energy for an average of only two hours per day on his demand, he would be short 35 cents per month of meeting his proportion of the expense curve "B" when paying by the rate shown by curve "A." The other similar consumer would have to use energy eleven hours per day when the same rate is applied in order to cover the cost of service of both consumers. The pecuniary loss in the sales of energy below cost to many short-hour consumers has to be made up, in order that the company furnishing service may meet its obligations. As it was shown, when a customer uses energy for two hours per day on his actual demand the shortage cannot be made up on a like average consumer unless he should use energy for eleven hours per day. It is therefore necessary with the type of step rate here shown to have some larger long-hour consumers who pay a rate sufficiently high to cover their cost plus the deficiency of many short-hour users.

As previously stated, the curves "C" and "D" show the amounts of the consumers' monthly bills. The length of the ordinate between curves "C" and "D" inside of space E, F. G. H, E shows the loss on any consumer having a demand of 4/10 kw who uses energy from an average of no

hours per day to two and three-quarter hours per day. The difference between the two curves vertically inside the space G, I, J shows the amount the long-hour consumers pay more than they would on the cost curve "D," but which is necessary to make up for the losses represented by the space E, F, G, H, E.

The lower the initial rate is made the higher the long-hour consumer's average rate will have to be until the two ends, maximum and minimum, are brought together and the schedule becomes one straight horizontal rate. It has been demonstrated by practice that such a rate does not develop the electric sales of energy to the company's and consumer's mutual benefit. It is then necessary to make an analysis and endeavor to classify the consumers somewhat in proportion to their cost.

Another method of analysis is to estimate the actual output cost on the basis of the present plant with increased load-factor. There are then certain items which would not vary much with the increased sales, such as organization expenses, labor, etc. Repairs would not increase in proportion, as each piece of apparatus would have a larger load to carry instead of running light part of the time, and the maintenance would not be on an additional machine. The above class of expense mentioned would then have a larger percentage fixed, and the output expense would then become more one of actual material used to generate electricity, such as coal, water, etc. The probable increased cost due to additional apparatus, etc., would not be considered, but the cost would be taken at one point in the saw-tooth curve.


Kw-hours
Curves of Cost
Based 4/10 kw Demand
Curves A and C
Based on 14 cents for first 30 hours per month
8½ cents for next 60 " " "
5 cents for all over 90 hrs " "
Curves B and D
Based on Consumers cost 91 cents per month
Demand 4/10 kw $100 per month
Energy $0.025 per kw-hour
Curves O and P
Based on Increased Load on Present Investment & Capacity
Consumers cost $123 per month
Demand 4/10 kw $170 " "
Energy $0.026 per kw-hour
Cents
Dollars
Hours per Day
Kw-hours Consumption per Month
Basis of Bill

Cost of Electric Service.

The following segregation of expenses is based on this assumption. The proportion of the rate of return and depreciation is subdivided in proportion to the expense and added, as previously stated in the other example. The consumers' expense would then become $42,795.42; the equipment expense $61,161.91, and the output expense, $39,018.82.

The average consumer cost per year would then become $14.75 instead of $11, the equipment expense $51 per year per kilowatt demand coincident with the maximum station demand instead of $30, and the output cost of energy $0.025 per kw-hour instead of $0.0475. Curve "O" is the unit cost curve similar to curve "B," and curve "P" the consumer's monthly bill with the same hours of use as shown in curve "D."

This analysis would be incorrect for a physical and investment growing property except for off-peak business. It would increase the cost of energy to the short-hour user enormously, and not in the proper proportion, as the plant increases. The analysis is, however, useful in order to obtain a figure per unit of increased sales on the present plant for a long-hour consumer, one who adds materially to the load-factor and does not absorb much of the available capacity, but pays a fair proportional rate of return and depreciation on the actual use of energy. Such a consumer on a hydroelectric plant might be very profitable, especially when water is running over the dam.

In fact, the cost to the company might under certain conditions be extremely low, and the rate of return and depreciation could not be equitably subdivided in the way stated; but a larger percentage of these two costs would be added to better the load-factor, in order to make the price to be paid more in proportion to the cost of other sources of power (and the value of the service to the consumer). This method would not be detrimental to maximum development of sales, and would have a tendency to give the short-hour consumer a lower rate by reason of the interest and depreciation earned per kw-hour by the long-hour, off-peak consumer, and still obtain the proper net earnings. Another method which is used is to assume that the proposed consumer is being served at a rate which is considered fair to the company and all its consumers, then to assume that service would be discontinued to the consumer and estimate the loss or benefit to the company and its other consumers, from an operating cost basis, and the change of cost and service to the other consumers of the company, in relation to the price paid.

The following is an example of a method used at the same plant: A long-hour customer was to purchase energy eighteen hours per day at the station switchboard. The demand was to be about 24 per cent of the maximum station demand; besides, some special investment had to be made to provide the service. It was found from a careful analysis that this customer would increase the load-factor for the eighteen hours very materially, thereby increasing the general efficiency of the plant. Energy could be sold on the basis estimated for approximately 2 cents per kw-hour, and at that rate the consumer would pay his fixed expense, interest and depreciation and the plant as a whole be benefited. It was assumed that this customer would be unprofitable and should not be connected; but after the analysis the contract was consummated and the actual results substantiated the estimates.

Of course, no example will fit all cases, but general principles can be arrived at and then each specific case can be worked out more easily. No doubt when the question of

rates is generally better understood the public will be satisfied to leave the destiny of a property to its logical managers as long as it is known that the public is receiving good service at a proper price.

THE POOR ECONOMY OF UNDERLOADED ENGINES.

One of the commonest mistakes made in purchasing apparatus for small electric power plants is to select engines of such large size that one of the engines must be operated at a very small fraction of its rated load for a large percentage of the time. Non-technical owners and engineers of limited operating experience often fail to realize how much coal is wasted in this way.

An illustration of this was recently obtained in a small central station which contains one simple Corliss engine driving a 90-kw generator and one compound condensing medium-speed engine driving a 175-kw generator. The 90-kw generator is operated alone except during the peak-load period. Even this small unit is only about one-quarter loaded during daylight hours. On one occasion recently when it became necessary to operate the large unit for twenty-four hours the coal per kw-hour immediately increased about 25 per cent over the ordinary running conditions.

Wiring and Illumination

THE DANGER IN IMPERFECT GROUND CONNECTIONS.

While the importance of grounding secondary circuits in order to render them safe against the possibility of accidental connection with high-tension wires is fairly understood and is generally practised by the large electric-light companies of the country, there is perhaps an insufficient appreciation of the necessity for having ground connections in perfect condition. A poor ground connection is worse than none at all on account of the sense of false security which it inspires. Whenever there is a connection between high-tension lines and ordinary lamp circuits there is a dangerous condition because of the possibility that some person's body may complete the connection between high-tension lines and ground. The possibility of such accidents is increased when in addition to the accessible lamp cords and switches there is added a ground wire running down a pole to an imperfect ground, the wire being exposed so that it is possible for persons or animals to come in contact with it.

Ground rods or plates in dry, sandy or rocky soil are of very uncertain value and should not be depended upon. Wherever possible ground connections to water pipe should be secured. The ineffectiveness of ground connections in dry, sandy, rocky soil has been many times tested and a most deplorable practical test of the poor quality of such connections was recently made by a central station operating in northern Michigan. This company grounded its secondary wires to a guy wire, the anchor of which was thought to be buried in the ground far enough so that a good ground connection was secured. An accidental connection between high-tension and low-tension wires occurred, thereby rendering the guy-wire ground connection alive because there was insufficient contact with moist earth to cause the fuses on the high-tension line to open. A calf was killed by coming in contact with the guy wire. A veterinary surgeon coming along later to investigate the condition of the calf leaned against the guy wire and was also killed.

THE CONTRACTOR AND THE CENTRAL STATION.

In reviewing the relation between the contractor and the central station under the general conditions prevalent in large cities, Mr. Arthur Williams, of the New York Edison Company, in a paper presented at the recent annual convention of the National Electrical Contractors' Association, grouped contractors as a whole into three classes. He stated that the relation of each one of these classes toward the central station differs materially, but that in every case considerable light is shed on the reason why a central station is so willing to meet the contractor more than half way.

The first class mentioned comprises contractors who constitute in reality engineering firms. They, as well as their financial resources, are so great as to enable them to enter upon operations requiring large outlays of capital. The work performed by them, such as the wiring of large office buildings, hotels, department stores, etc., is of a size to bring up the question whether the energy should be supplied from a private plant or purchased from the central station. This question is, of course, settled by the owner, acting under the advice of his consulting engineer, but Mr. Williams contended that, even if the character of the service be decided before letting the contract for the electrical work, the contractor himself will often exercise a wide range of influence. The influence, indirect though it may be, is distinctly weighty, and to have a firm of some standing look unfavorably upon central-station service augurs ill for that service. In installations where the conditions mentioned do not exist contractors' recommendations for or against the central-station service very often largely influence the decision.

The second class of contractors referred to by Mr. Williams usually do business on a considerably smaller scale than the first class and limit their range of activity to a single city as a rule, or in the direction of residences, apartment houses or loft buildings. The offices of these contractors are frequently used for display purposes, and they promote in no small degree the many uses of electricity which naturally redound to the profit of the central station. Moreover, from this second group the great engineering contractors develop, so that the service any one of them gets from the central station at first has much to do with his opinion when his business expands.

The third kind of contractor is usually found in a less prosperous neighborhood than the other two, and his work in the main is confined to small lines of installations, consisting chiefly of the small stores and cheaper dwellings. Much of this work is secured through personal solicitation, and many of the persons thus often brought to be fairly large users of electricity could hardly have been successfully approached by a central-station agent. Many contractors notify the central-station company when they are asked to bid on isolated-plant installations, and many central stations in turn refer people who come for wiring to a number of good contractors in their locality. Mr. Williams said that when it is considered that from one of the branch offices of a large lighting company about 2000 contractors are dealt with, and these are located so closely together that within eight blocks may be found more than a dozen, it becomes sharply evident how much good feeling means to the central station. Granting the value of the contractor to the central station, Mr. Williams maintains that the latter should for its part concede freely his due.

For business reasons, as well as for abstract justice, Mr. Williams said that the central station should afford contractors fair and generous treatment, and if this is done the contractor will in almost every case pass on to his customers the impression that they too may expect fair dealings from the central station and proper adjustment of whatever difficulties may arise. The central station, according to Mr. Williams, also owes it to the local con-

tractors to keep good, straight, competent agents in the field. The contractor in building up his own trade brings in business to the central station, and obviously the latter should do its part in reciprocating the favor. As a part in fulfilling this obligation, the central station should do a certain amount of advertising advising the use of electrical energy which, although of a general nature, brings in returns to the contractors throughout the entire territory. It is also due to the contractors that the central station have a fair, clear and impartial schedule of rates, such that the contractor can hope to obtain business under them.

Pointing out means by which the contractor and the central station can co-operate to the benefit of both, Mr. Williams stated that the contractors would find it greatly to their advantage to maintain showrooms, where all kinds of devices suitable for the home or business use of the locality could be displayed. The contractor being more closely in touch with his neighborhood, his display will be more effective than one undertaken by the central station, since the contractor is aiming to meet and stimulate a very local rather than a general demand. Mr. Williams stated that there is abundant opportunity for enormously enhanced growth and the application of more efficient methods in the electrical field. There are also a very broadening range of appliances by which electricity can be advantageously utilized and a growing interest in and appreciation of their practical benefit. He felt that the contractors should do their share toward accomplishing this growth, and from their activities in the past he was confident of the ultimate result.

ONE-PIECE VERSUS TWO-PIECE PUSH SWITCHES.

By Eugene E. Smith.

In electrical installations careful study should be made of all points in connection with the materials used and their maintenance. Each article selected should be analyzed as to its good and bad points in cost, construction and maintenance. In this connection the flush push-switch problem is often overlooked, and the cheapest article is often selected, with bad results. The field of push switches is wide, and prices and results vary. The switches are divided into two general groups, the one-piece and the two-piece switch; by this is meant one in which the mechanism is permanently fastened to its shell and one in which there is a detachable mechanism. The one-piece switch has been in existence since the beginning of electrical control, and has been improved upon from time to time, until improvement had to take a long jump and the detachable-mechanism switch was evolved, with many points in its favor. Granted that the action of one mechanism is as good as the other under conditions that are ideal but which seldom obtain, the danger of damage in the case of the one-piece switch is often detrimental to the proper action of the mechanism. A favorable point to the credit of the one-piece switch is its first cost. The cost to install each switch is equal, but the mechanism of the one-piece switch is liable to injury from all sources, while in the two-piece switch the shell can be installed independently of the mechanism; that is, the wires can be permanently connected and a protecting sheet placed in the shell. The mechanism is thus not liable to damage by plaster, paint, water, etc., present in both new and old buildings. These points are very often overlooked, while they are very important to switch maintenance. Complaints are very often lodged against a non-operating switch, and in the majority of cases defective operation is due to damage caused by plaster getting in the mechanism, or paint causing the push points to stick, or water or dampness causing the mechanism to rust. These defects are likely to present themselves in the one-piece switch, because of the necessity of installing the switch before work is finished in the building, so as to complete the electrical contract on time. The use of the two-piece detachable-mechanism switch avoids all this trouble, because of the installation of the shell only, thus saving the mechanism from possible damage by the causes given. The installation of the mechanism calls for so little additional labor that no account need be taken of it. The replacing of a switch mechanism that has given out by hard usage is a big item to be considered when making the initial installation. This may seem a consideration that is a great distance off, but no one can judge the actual operation of any movable mechanism, as can be seen by the guarantees that are given, which seldom run over two years. The installation of a push switch is often made with the idea that it will last as long as the building; but that is poor judgment, and the question of replacement should be taken seriously. The replacement of the one-piece switch means labor and cost equal to the first installation; that is, purchasing a complete mechanism and shell, disconnecting wires and switch and reconnecting wires and switch, with the possible breaking of wires from bending and handling, thereby shortening them and requiring a new circuit or tap, which means added labor and expense. The replacement of a two-piece switch means the removal of the plate, the pulling out of the defective mechanism, the insertion of the new mechanism and the replacement of the plate, all of which is done in less time than it takes to write about it. The cost for replacement is in favor of the two-piece, detachable-mechanism switch. In making replacements damage done to the surrounding walls has to be considered, if it is done in a place where looks count for something, as in a hotel, residence, public hall, school, office, etc. The detachable-mechanism switch, which requires little labor and that of a clean nature, thus scores a point. Another point that may not be serious, but is worthy of consideration, is the element of time when a replacement is to be made, say, in a guest's room in a hotel. There need nothing be said regarding which switch is more advantageous under these conditions. The installation of a one-piece switch under similar conditions would mean that the electrician would have to take tools, an extension lamp cord and a one-piece switch. Arriving at the room, he would have to disconnect the defective switch and reconnect the new switch, always taking the precaution not to soil the walls. There are a number of instances that could be cited to the credit of the two-piece detachable-mechanism switch.

ELECTRIC LIGHTING FROM THREE-PHASE CIRCUITS.

By G. P. Hoxie.

It is prevalent practice to distribute electrical energy in industrial plants by means of the three-phase system, principally because of the simplicity and reliability of the induction motor. Although other voltages are used, 220 and 440 are the most common. Usually the proportion of the

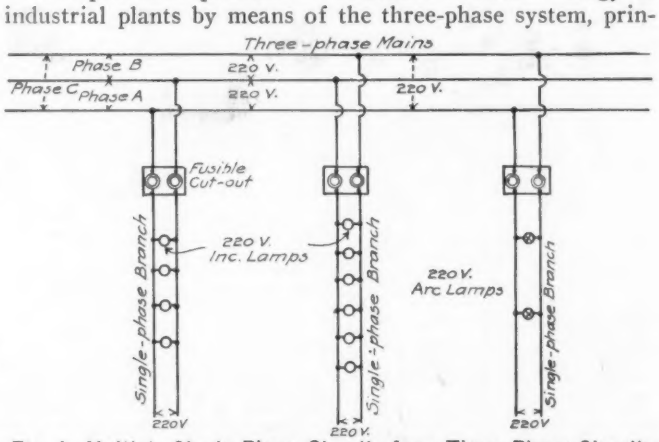


Fig. 1—Multiple Single-Phase Circuits from Three-Phase Circuits.

total energy generated required for lighting is small. Most of it is utilized for motor circuits and its adaptability for electric lighting is of secondary importance. Practically all lighting equipment operates only from single-phase circuits; but as a rule it is not advisable in industrial plants to generate single-phase current solely for lighting service. So some plan must be adopted whereby single-phase circuits for the operation of lighting equipment can be arranged from three-phase circuits. In this article some methods of doing this are discussed.

One of the simplest schemes for lighting from a three-phase circuit is suggested in Fig. 1. Single-phase branches

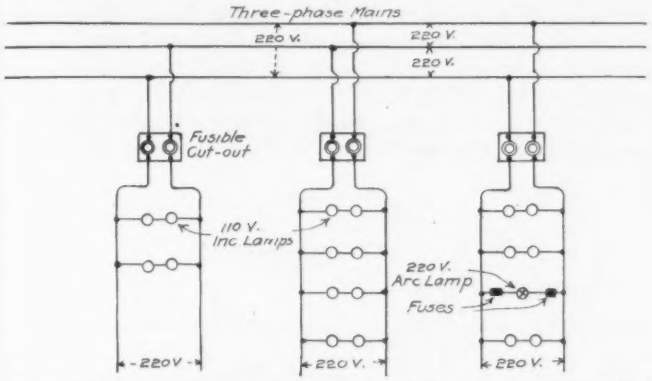


Fig. 2—Series-Multiple Single-Phase Circuits from Three-Phase Circuits.

are tapped from the three-phase main and the voltage across each branch will be the same as that between any two wires of the main. In arranging circuits after the manner shown, the loads on the branch circuits should be so divided that each of the three phases will be about equally loaded. That is, phases *A*, *B* and *C* (Fig. 1) should each serve groups of lighting appliances of approximately equal inputs. Fusible cut-outs should be inserted in each branch circuit where it branches from the mains.

In Fig. 1 the mains have a potential of 220 volts, therefore 220-volt incandescent and arc lamps can be fed from the branches. With 440-volt, three-phase mains it is not usual to connect single-phase lighting circuits direct to the mains. Some type of transforming device is interposed between the mains and the branch lighting circuits, as will be hereinafter described.

Carbon-filament incandescent lamps for 220 volts cost more than do similar lamps for 110 volts and they have shorter lives and are less efficient than are 110-volt lamps. Consequently in some installations, where three-phase energy is distributed at 220 volts, 110-volt carbon incandescent lamps are operated two in series as indicated in Fig. 2. In these installations multiple arc lamps are used that are built for operation on 220 volts. Metallic-filament lamps for 110

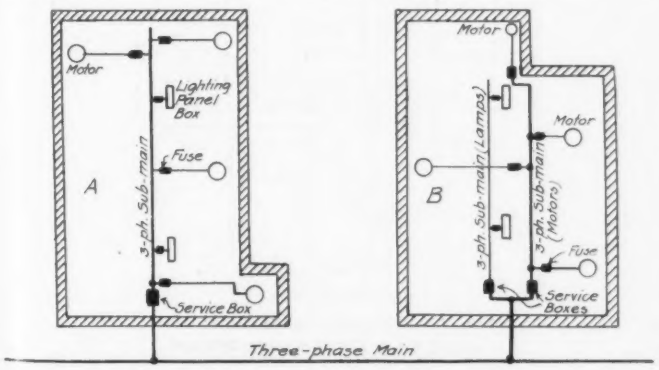


Fig. 3—Wiring from Three-Phase Mains.

volts are cheaper, more efficient and have longer lives than similar ones for 220 volts and have more rugged filaments, hence are less liable to breakage. For these reasons metallic-filament lamps are sometimes connected as outlined in Fig. 2. When ordering metallic-filament incandescent lamps that are to be operated two in series it should be specified in the order that the lamps are for series operation so that they can be especially selected for this service. Metallic-

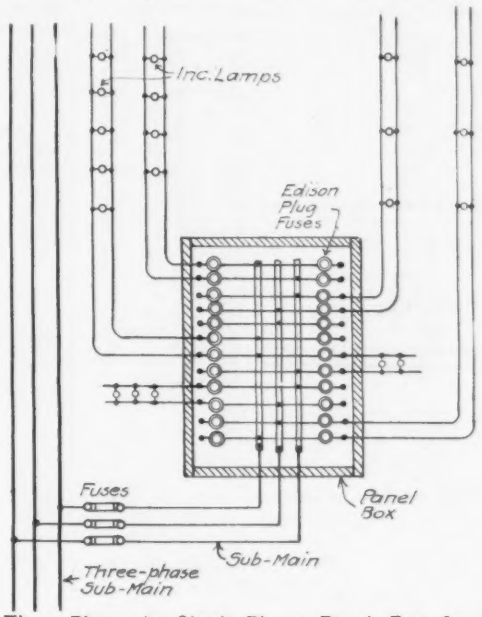


Fig. 4—Three-Phase to Single-Phase Panel Box for Lighting System.

filament lamps are designated by their nominal inputs in watts and two lamps of the same nominal input may vary considerably in actual input. If two such lamps, having different inputs, are connected in series across a circuit of twice their nominal voltage, one of the lamps may be considerably overloaded and will have a correspondingly shorter life.

Two plans for wiring buildings for motors and lamps using three-phase sub-mains are shown at *A* and *B*, Fig. 3. The lighting panel box used is shown in Fig. 4. Both of the buildings are served from the three-phase main in the street in front of them. In the plan *A* energy for both lamps and motors is taken from the same sub-main which traverses the center of the building, while at *B* individual sub-mains are arranged for lamps and for motors. Where it is essential that the wiring be installed economically and the motors served are of small size the plan indicated at *A* can be used; but where a first-class installation is desired it is better to divide the lamp and motor sub-mains as suggested at *B*. The disadvantages of plan *A* are (1) that the heavy momentary currents, drawn by the motors at times

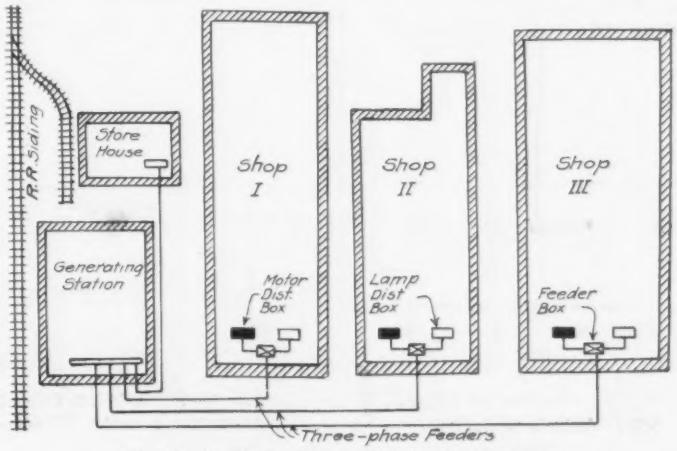


Fig. 5—A Three-Phase Distribution System.

of starting or of changes in load, may cause poor voltage regulation and the consequent unsteadiness of light, and (2) that trouble on the motor circuits may melt the main fuse and extinguish all of the lights. It is assumed for plans *A*

and *B* that the voltage regulation on the main in the street is good. With plan *B* conditions on the motor circuits cannot to any extent affect the regulation on the lighting submain, as it is independent and the fuses protecting the motor

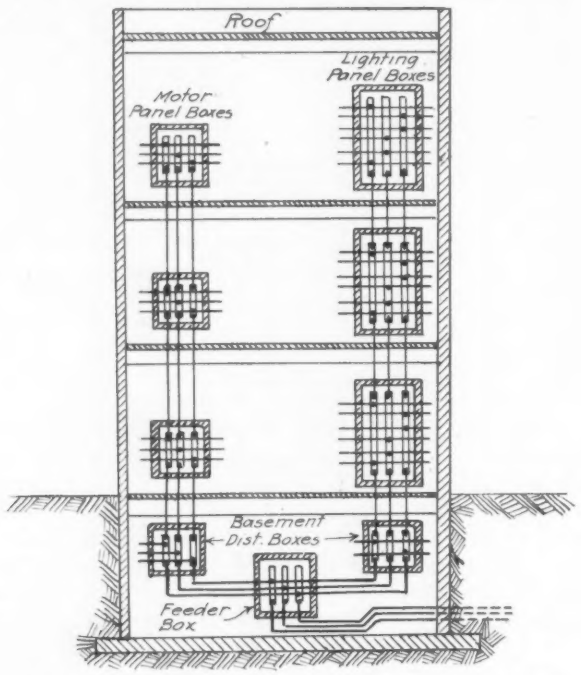


Fig. 6—Plan of Wiring for Building of Several Stories.

sub-main can melt without extinguishing the lights, because only energy for motors feeds through them.

In Fig. 4 is delineated a method of arranging a panel box that might be used in plan *A* or *B*, Fig. 3. Three conductors are "tapped" to the three-phase sub-main and carried, through fuses, to the three busbars of the panel box. In the panel box the single-phase branch circuits are connected successively across each of the phases, in rotation, so that the lighting load will tend automatically to balance itself. Edison plug cut-outs are interposed between the busbars and the terminals of the single-phase branch circuits. The scheme of connections indicated in the panel box of Fig. 4 is merely an elaboration of that suggested in Figs. 1 and 2. In Fig. 4, if the sub-mains operated at 220 volts, 220-volt incandescent lamps would be used, or 110-volt lamps might be used in groups of two in series like the arrangement of Fig. 2. If the sub-main pressure was 110 volts, 110-volt lamps would be used on the branch circuits. If the voltage on the sub-main was 440, some other method would be utilized as hereinafter outlined.

A three-phase distribution system for an industrial plant is indicated in Fig. 5. An individual three-phase feeder is carried from the generating station to each of the buildings on the property. Just within each of the three larger buildings, Shops I, II and III, the feeder, after passing through a service switch and fuses, is divided and carried into a distribution box for motor circuits and into one for lamp circuits. The storehouse is served by a small feeder terminating in a lighting distribution box. If the buildings have but one story, motor branch circuits might feed direct from the distribution boxes, or mains might be carried from them the length of the buildings and motor branch circuits would be connected to the main as outlined at *B*, Fig. 3. Lighting circuits, if the buildings of Fig. 5 were all of one story, might be arranged as detailed in Fig. 3*B* and Fig. 4. If the buildings were of more than one story, the plan of Fig. 6 could be adopted. In this diagram fuses and switches are not indicated. From the feeder box mains are carried to the distribution boxes, for motor and for lamp circuits, which are located in the basement. From the distribution boxes risers are carried through the floors above and panel boxes are located on each floor. Only one set of risers and panel boxes is indicated in Fig. 6, but with a building covering a large area several sets, duplicates of those shown, might be necessary. The distribution boxes in the basement would, in such a case, be so arranged that all of the risers—which would be mains—would feed from them. It might be desirable in some instances to carry individual mains from one of the distribution boxes to each of the panel boxes or to a group of two or three panel boxes. This plan would probably be followed, particularly with the electric-light circuits, if a building of six stories or over were being wired. The reason for this is that circuits can be designed to provide closer voltage regulation if small groups of boxes—rather than large groups—located reasonably close together are each fed with an individual main.

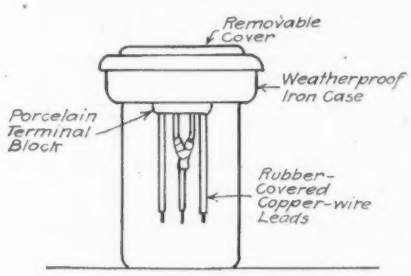


Fig. 8—Auto-transformer.

Because they are very economical of copper and permit the use of individually fed 110-volt incandescent lamps (instead of two 110-volt lamps in series) 110-220-volt three-wire circuits are very extensively used for distributing electical energy for interior lighting. Three-wire, 110-220-volt alternating-current circuits can be obtained from 220-volt, single-phase, alternating-current circuits with an auto-transformer as shown in Fig. 7. How this principle is applied to three-phase circuits will be shown later. Auto-transformers for this and similar services are regularly manufactured and are usually arranged in standard transformer cases as suggested in Fig. 8. The load on such an auto-transformer is equal to the difference in the loads on the two sides of the three-wire system and the size of the auto-transformer to be used can be determined accordingly. For example:

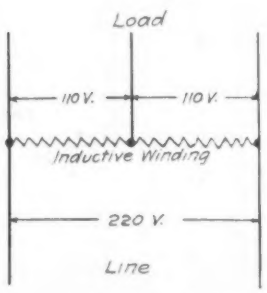


Fig. 7—Diagram of Three-wire Auto-transformer.

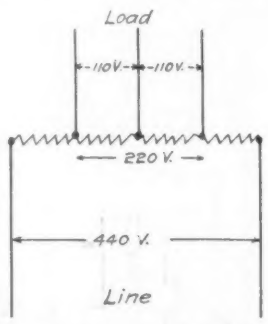


Fig. 9—Three-Wire, 440-Volt Auto-transformer Diagram.

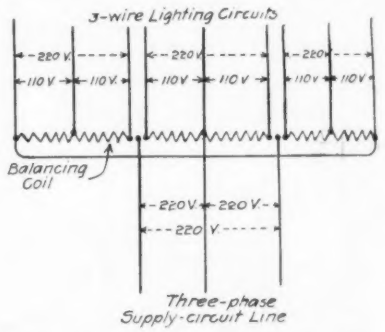


Fig. 10—Three-Wire Systems Balanced on a Three-Phase System.

If the load on one side of a three-wire system, like that of Fig. 7, were 100 amp and the load on the other side were 150 amp the auto-transformer would be loaded with but 150 — 100 = 50 amp. The amount of unbalance that should be provided for in each case—hence the size of the auto-

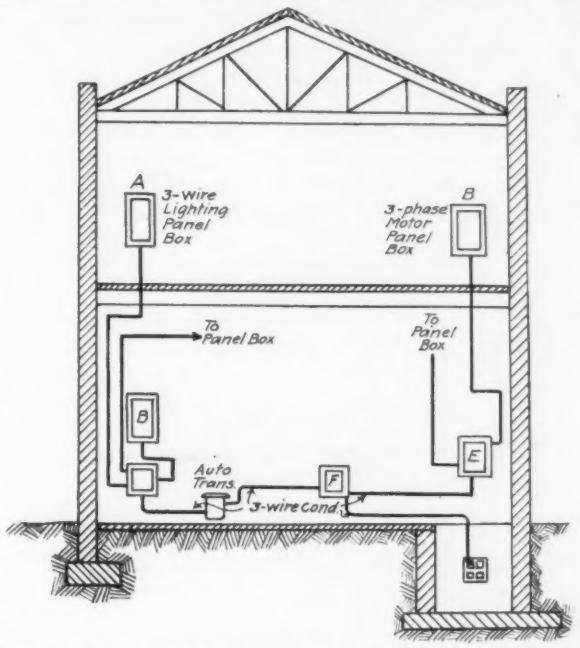


Fig. 11—Auto-transformer for Lighting of Factory Building.

transformer—is determined by local conditions. If there is probability of great unbalance and if the lamps must be kept burning at any reasonable cost, it should be assumed that one side of the three-wire system may be fully loaded while there is no load on the other side. This would mean that the auto-transformer should have a rating equal to the entire load on one side of the three-wire system. However, in practice the amount of unbalance does not, where branch circuits are carefully laid out, often exceed 10 per cent of the total load. On this basis the rating of an auto-transformer should be 10 per cent of the total load to be connected to it. In some installations the amount of unbalance on a three-wire system is very small, not exceeding 5 per cent at any time. But in other cases the unbalance may be as high as 15 per cent or even 30 per cent. A 10 per cent unbalance is probably a fair average working amount.

If an auto-transformer is selected on the basis of slight unbalance, say 10 per cent, and the unbalance becomes excessive, there is not very much that can happen if all cir-

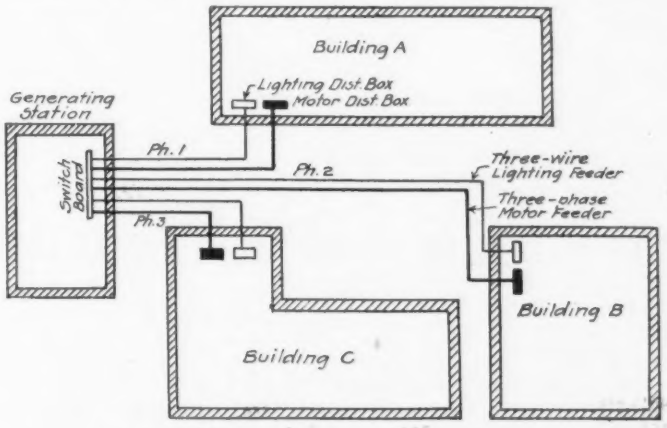


Fig. 12—Lighting and Motor Feeder Lay-Out.

cuits are properly protected by fuses. Voltage above normal may for a time be impressed on the lamps on one side of the three-wire system if a fuse is melted by overload, or currents may flow that are great enough to melt fuses, extinguishing or dimming the lights. But these difficulties reveal themselves, are readily corrected and ordinarily do no serious harm.

Inasmuch as auto-transformers can be purchased that are mounted within weatherproof cast-iron cases they can be arranged on the outside walls of buildings or on poles. Apparently there are no specific rules governing the installation of large auto-transformers, or balance-coils as they are sometimes called in the National Electrical Code. For this reason it would probably be best to confer with the local inspection bureau before making an installation to find just what the district representative would require. It is probable that the rules that govern the installation of transformers would also govern the installation of auto-transformers.

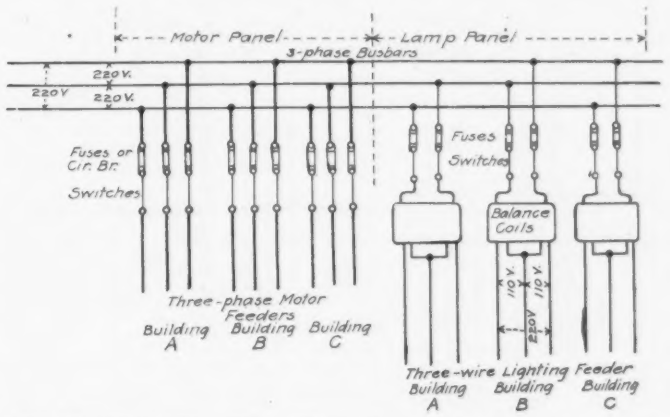


Fig. 13—Three-Wire, Three-Phase Circuit for Motors and Lamps.

That is, they must not be placed inside of buildings, except stations and substations, without special permission, and when they are placed inside of buildings certain precautions must be taken to prevent the spread of fire in the event of the oil in the cast-iron case becoming ignited. A fireproof inclosure of some sort, well ventilated to carry away oil fumes, would probably be required in buildings other than stations and substations.

Three-wire circuits are, with auto-transformers, obtained from 220-volt, three-phase circuits by connecting an auto-transformer, like that of Fig. 7, across any one or across each of two or of the three phases. In Fig. 10 a diagram is shown of three auto-transformers, each serving a three-wire circuit and each connected across one of the three phases. Three-wire 110-220-volt circuits can be obtained from any one of the phases of a 440-volt, three-phase system by using an auto-transformer such as that indicated diagramatically in Fig. 9. Equipment for this service can be purchased from any of the principal builders of transformers.

Transformers can, of course, be used for any application shown herein for auto-transformers. But, as a rule, trans-

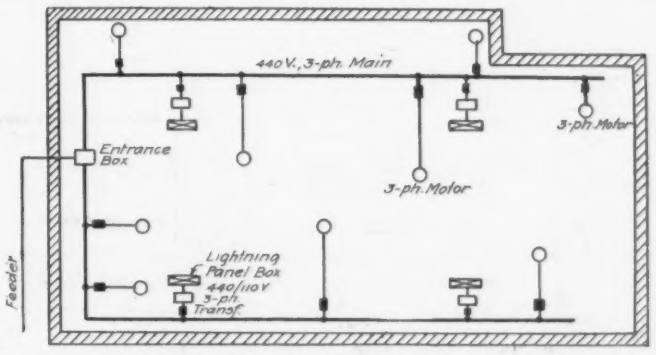


Fig. 14—Lighting Circuits Fed Through Transformers.

formers for a given application will be more expensive than auto-transformers. This is because a transformer has two windings, a primary and a secondary, and because a transformer must always have a rating equal to the full load on the three-wire system. It should be noted that an auto-

transformer, arranged between a single-phase and a three-wire system, must have sufficient rating to accommodate the full load current in the line wires of the single-phase system unless the voltage across the outside wires of the three-wire system is impressed on the auto-transformer. For example, an auto-transformer operating as indicated in Fig. 7 need not necessarily be of sufficient size to accommodate the primary current in the 220-volt line, while the auto-transformer suggested in Fig. 9 must be of a rating to accommodate the primary current in a 440-volt line. Transformers possess one advantage over auto-transformers. With auto-transformers the secondary circuits are electrically connected to the primary circuit and a ground on the secondary circuit may have the same effect as one on the primary circuit. Furthermore the secondary circuits are at primary potential above ground and may give a severe shock to a person coming in contact with them if there is a ground on the primary circuit—and there usually is. With the transformer there is no electrical connection between primary and secondary circuits, so neither of the above objections holds.

When auto-transformers are used on three-phase circuits to feed three-wire systems they should be connected on the three phases as outlined in Fig. 10. The three-wire mains and the branch circuits for lighting should be so loaded that each phase will be almost equally loaded. Some unbalancing will not appreciably affect the operation of the three-phase system. Just the amount of unbalancing that would be permissible is determined by the characteristics of the three-phase generator, the load on it, and by the character of the equipment connected to the three-phase circuits. It is probable that, with the average generator, there can be, when it is operating at about full load, a load unbalance of possibly 25 per cent between the most lightly and the most heavily loaded phases without the voltage regulation being affected enough to make trouble.

Suggested in Fig. 11 is an arrangement of equipment in an industrial building whereby three-wire, 110-220-volt lighting circuits are fed through an auto-transformer from a three-phase feeder. On entering the building from the subway, the three-phase feeder enters a feeder box where mains are branched from it. One phase only, for lighting, continues to the auto-transformer, and the other three-phase branch for motor circuits is carried into the three-phase distribution box. From this box mains are carried to panel boxes located about the building. From the auto-transformer the three-wire main enters the three-wire lighting distribution box. From this box three-wire mains are run to lighting panel boxes situated in the various departments in the structure. From the panel boxes single-phase branches are brought out and to these branches the electric lamps are tapped. The method of Fig. 11 resembles somewhat the scheme indicated in each of the buildings of Fig. 5. The difference is that in Fig. 5 the lighting mains are three-phase while in Fig. 11 they are three-wire.

A single auto-transformer, like that in Fig. 11, on one phase of a three-phase system might unbalance the system excessively, but this can be avoided by installing auto-transformers in other buildings on the other phases. The connections for the auto-transformer in Fig. 11 are shown in Fig. 9.

It is, as hereinbefore outlined, often desirable to install individual feeders for lamps and for motors. This applies whether auto-transformers are used or not. In Fig. 12 is shown the feeder layout for a manufacturing plant generating 220-volt, three-phase energy and using separate feeders for motor and for lamp circuits. The pressure on the three-phase motor feeders is 220 volts and that on the lighting three-wire feeders is 110-220 volts. Auto-transformers connected as shown in the feeder diagram, Fig. 13, are utilized to obtain three-wire circuits from the three phases. The notation on this diagram corresponds with that on Fig. 12 and indicates how the motor and the lamp feeders are apportioned.

In at least one factory the method of lighting from three-phase circuits shown in Fig. 14 has been used. The three-phase mains operate at 440 volts and at each lighting panel box a transformer is installed which reduces the pressure to 110 volts for the lighting circuits. Three-phase busbars, fed by the transformer secondaries, are arranged in each box and from these buses single-phase branches are tapped. The connections within the lighting panel boxes are substantially the same as those indicated in Fig. 4. Three-phase motors operate from the same mains that supply the lighting energy.

Letter to the Editor.

Electrical and Other Causes of Fire.

To the Editor of Electrical World:

It appears to be the rule to ascribe to an electrical cause the origin of a fire when the real cause is not known. A recent experience of the Terrell Electric Light Company, of which the writer is manager, indicates one of the causes of fire which seem to have been overlooked, and which in other cases may be attributed to electric wires. In the morning a fire was discovered in the roof of the boiler-room of the Terrell Electric Light Company and was extinguished before any damage was done. Upon a thorough examination it was found that in four separate places accumulations of soot and dust, which had settled on the truss joists of the boiler-room and on the iron-stack breeching, were afire, and there appears to be no doubt that the origin of the fire was from spontaneous combustion of such a small pocket of soot and dust. This evidence makes it clear that many fires attributed to incendiarism, electric wires and bad fuses may be caused by an accumulation of old rags and clothing, soot and dust covered, in attics and out-of-the-way places. If attics and closets of residences were cleaned up occasionally, we should probably have fewer fires.

Terrell, Tex. E. D. Kelly.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Characteristics of the Mercury-Arc Converter.—J. W. Elliott and S. C. Parsons.—A record of experiments made upon a 200-volt, 50-cycle mercury arc, delivering 10 amp direct current at 110 volts. An investigation was made of the changes taking place in the state of the arcs during their passage from the anode to the cathode. Referring to Fig. 4, the interval during which an arc exists between either C_1 or C_2 and D is 0.01 second, which is too short to permit the changes to be perceived by direct vision. The authors adopted a stroboscopic method of viewing the arcs during their various stages. For this purpose a disk of stiff paper having three slits spaced 360 electrical degrees apart was mounted on the shaft of the six-pole alternator supplying energy to the converter. By shifting the position of the disk with reference to the poles on the alternator, the arcs were viewed in various conditions, just as though each condition viewed remained

constant. Photographs obtained stroboscopically showed that the time-angles of overlap at the two anodes are widely different, being about 15.5 electrical time degrees at one anode and about 70 degrees at the other anode. Oscillographs taken of the wave-form of voltage revealed a lack of symmetry in the positive and negative half-waves. The authors expressed the opinion that this result was attributable to a difference in the inductance in one anode as compared with that in the other, due to the position of the inductance coil in the direct-current circuit, which was placed in close proximity to the inductance in one of the anode circuits which is wound on the end of the transformer coil. Fig. 1 is the voltage wave of the alternator when the converter was delivering 9.7 amp to a carbon-filament lamp. The unidirectional voltage obtained directly from the converter at this load is shown in Fig. 2, while Fig. 3 shows the unidirectional voltage delivered to the load circuit, the effect of the inductance coil *G* (Fig. 4) being very marked in smoothing out the wave-form.—Lond. *Electrician,* July 14.

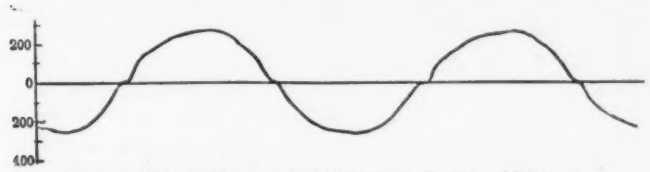


Fig. 1—Wave-Form of Alternator Supply Voltage.

Transformers for Metallic-Filament Lamps.—F. NIETHAMMER.—An illustrated article on tests of transformers made by a German company for operating low-tension metallic-filament lamps from commercial supply mains. The transformer is always switched in or out on the primary (network) side, so that the no-load losses are avoided. It is possible to use lamps as small as 5-cp, 14-volt on 200 to 500-volt mains. The price is less, the specific consumption in watts per cp is less, and the life much longer than with ordinary 110-volt lamps. In some cases the watts consumed per cp by such a low-voltage lamp, together with transformer, are less than those consumed by an ordinary-voltage lamp without transformer. The author gives the results of tests of such small transformers. The efficiency determined for six different sizes varies between 88.3 and 98.9 per cent, figures being also given for voltage drop, power factor, etc. The author finally gives the accompanying comparative figures for a 110-volt, 16-cp metallic-filament lamp without transformer and a 14-volt, 16-cp metallic-filament lamp with transformer. The figures refer to one 16-cp lamp.

	110 Volts Without Transformer.	14 Volts With Transformer.
Price of transformer	.....	$2.25
Price of lamp	$0.50	0.25
Watts per cp	1.1	0.95 primary
Life in hours	600	1,500
Cost of lamps for 3,000 hours burning	$2.50	$0.50
Cost of energy for 3,000 hours burning (at 72.5 cents per kw-hour)	6.60	5.70
Amortization of transformer, 100 per cent in 3,000 hours	.....	2.25
Total cost for 3,000 hours	9.10	8.45
Saving	.....	0.65

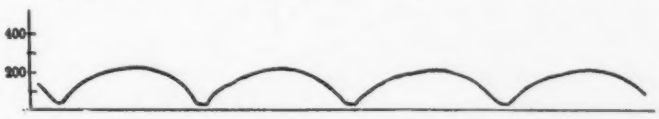


Fig. 2—Unidirectional Voltage Obtained Directly from Converter.

This computation shows that after 3000 hours of burngin the transformer has not only paid for itself, but has accomplished a saving of 65 cents.—*Elek. u. Masch.* (Vienna), April 30.

Lamps and Lighting.

Tests of Reflectors.—LEONARD MURPHY AND H. L. MORGAN.—A report of candle-power distribution tests made upon a 240-volt, 60.5-watt osram lamp with and without reflectors. The bare lamp gave a mean spherical candle-power of 36.3. When equipped with two types of prismatic reflectors the mean candle-power became 29.5 and 29.8; with a conical opal shade 10 in. in diameter, 5 in. deep, the mean candle-power was 29.8; with an enameled iron shade of the same size and shape, the mean candle-power was 20.95; when inclosed by a silvered glass reflector 8 in. in diameter, the mean candle-power was 29.4. Illumination tests were made with all of these equipments except the last in a room 42.5 x 23.0 x 12.5 ft. high, having light-brown walls and ceiling of poor reflecting quality, use being made of twenty equally spaced lighting units. Defining as the illumination efficiency the ratio of the useful flux at the table level to the total flux produced by the lamps, it was found that the efficiency had the following values: Bare lamp, 32.2 per cent; concentrating prismatic reflector, 46.8 per cent; diffusing prismatic reflector, 43.7 per cent; conical opal shade, 48.8 per cent, and enameled iron shade, 42.8 per cent. As a result of the tests the authors concluded that shades of the opal, prismatic or silvered-glass varieties may be expected to absorb from 17 to 20 per cent of the light; that with bare lamps about 30 per cent of the flux produced is available at the table level; with the most effective shades this may be increased to 50 per cent; that for rooms illuminated from a large number of well-distributed points, the height being great as compared with the distance between them, it is not necessary to use a shade which produces exactly any particular form of candle-power distribution, but the light should be directed generally downward, or upward if a clean, white ceiling is available for reflection. Additional observations relating to the distribution of illumination led to the conclusion that the illumination of an interior may be very non-uniform without this fact being apparent, especially when the illumination is partly or wholly indirect; that shadows are more or less objectionable according to their sharpness of definition, and that, in general, they tend to lower the practical efficiency of illumination.—*Lond. Elec. Review,* July 7 and 14.

Fig. 3—Wave-Form of Unidirectional Voltage to External Circuit.

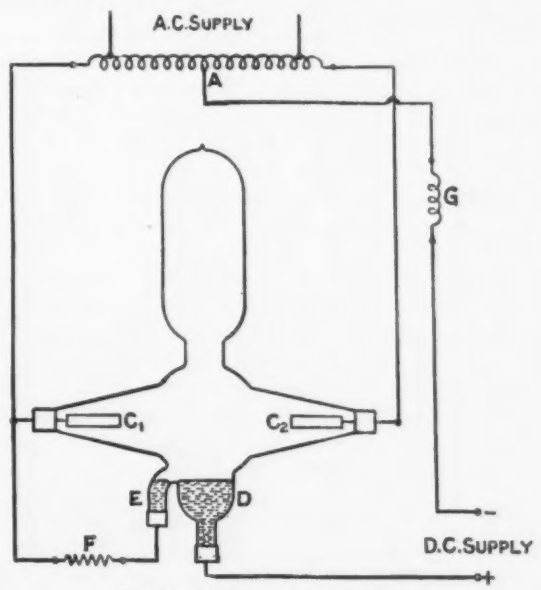


Fig. 4—Mercury-Arc Converter.

Lighting of Chicago Passenger Station.—C. A. Luther.—An illustrated article describing the electric lighting equipment of the new Chicago passenger station of the Chicago & Northwestern Railway. The station building occupies a ground area of 320 x 218 ft., and contains a main wating-room 100 x 200 ft., with a height of 85 ft. This room is illuminated artificially by reflected indirect light from 420 250-watt tungsten lamps hidden from view behind a ledge, and by direct light from fourteen electroliers suspended between the pillars on each side of the waiting-room. Each fixture is equipped with one 150-watt and twelve 100-watt tungsten lamps. At each end of the room are four standards, each carrying thirteen tungsten lamps. A mailroom on the street level is equipped with mercury-vapor lamps. At all other places tungsten lamps are employed, the ratings varying from 150 watts for general illumination to 25 watts for signs.—*Amer. Gas Lt. Jour.,* July 17 and 24.

Standard Specifications for Street Lighting.—The issue contains answers to a list of queries regarding the framing of standard specifications for street lighting submitted to various authorities in the United States and on the Continent. A summary of the views held by these authorities as given in tabular form is about as follows: The specifications should contain a statement of the electrical energy or gas to be consumed, but not necessarily the amount of light produced. The illumination should be measured in a horizontal plane at a stated height above the ground, measurements being preferably made of both the minimum and mean values. The contract should demand preliminary laboratory tests supplemented by periodical tests of the actual lighting conditions when the lamp is in position. No specific color of the light should be prescribed.—Lond. *Ill. Eng.*, July.

Generation, Transmission and Distribution.

Water-Power Plant for Constantinople.—L. Ostertag.—An article on the possibility of supplying electrical energy for traction and lighting purposes to the city of Constantinople, either by developing on the European side the Maritza River water-power with a transmission line of 200 km (120 miles) or by developing in Asia the Sakaria water-power, with a transmission line of 130 km (78 miles). The latter project, which would represent a very large source of power, is discussed in some detail and believed to be practical, although the time is not yet ripe for its realization.—*Elek. u. Masch.* (Vienna), April 30.

Spontaneous Combustion of Coal.—S. W. Parr and F. W. Kressmann.—Wherever large quantities of bituminous coal are stored the danger arising from spontaneous combustion must be taken into consideration. As a result of fifteen series of tests made upon Illinois bituminous coal, the authors determined the cause for oxidation of the coal in its various stages and suggested the following precautionary methods for minimizing the danger of spontaneous combustion: the avoidance of any external source of heat which may increase the temperature of the mass of coal: the elimination of finely divided coal; maintaining continued dryness in storage, or submerging the coal.—*Bulletin* No. 46, Univ. of Ill.

Traction.

Low-Speed Locomotive.—An illustrated description giving details of a 35-ton, 220-volt direct-current locomotive constructed for hauling coke at the Woodward (Ala.) Iron Works. The motors develop a tractive force of 10,000 lb. at the rated one-hour load, with a speed of 6 miles per hour.—*Elec. Railway Jour.*, July 8.

Railway Telephone and Semaphore.—A description of a combination telegraph and semaphore system which provides a selectively operated semaphore signal for use in connection with the telephone train wire, so that the dispatcher can talk to any train crew.—*Elec. Railway Jour.*, July 8.

Suspended Passenger Cableway to the Aiguille du Midi.—Alfred Gradenwitz.—A description of a passenger-hauling equipment being installed between Chamonix, at the foot of Mount Blanc, and the Aiguille du Midi, the difference in elevation between which is 2850 m (9350 ft.). The suspended cableway is constructed with three cables, the supporting cable serving as runway for the truck carrying the car, the endless driving cable situated underneath and a braking cable. Two cars will be operated for simultaneous uphill and downhill travel.—Lond. *Elec. Review,* July 14.

Installations, Systems and Appliances.

Electrolytic Spark-Suppressor.—A note on a British patent (No. 14,499, July 6, 1911) of W. A. Price, covering means for converting direct current into current suitable for driving alternating-current motors. Use is made of mechanical devices for interrupting the current and reversing the connections and of one or more electrolytic condensers acting in conjunction with auxiliary inductive and non-inductive circuits to obviate sparking.—Lond. *Elec. Eng'ing,* July 13.

Isolating Switches.—A note on a British patent (No. 2594, July 6, 1911) of Siemens Brothers' dynamo works and R. A. R. Bolton, relating to means for preventing the accidental opening of a switch under heavy short-circuit. The isolating switches are of the ordinary knife form, fitted with a spring-locking catch which can be disengaged only by a pull on the ring provided to open the switch by a hooked pole or otherwise. The ring is attached to a lever mounted on the blade which pushes up the catch when it is pulled.—Lond. *Elec. Eng'ing,* July 13.

Wires, Wiring and Conduits.

Railless Traction-Wire Support.—A note on a British patent (No. 3747, June 29, 1911) of H. Sefton Jones, dealing with the suspension and tension of the wires in a railless traction system. The conductors are suspended on U-shaped supports, one limb being surrounded with an insulated layer and provided with a head-piece, placed in a screwed-in protected bell, to prevent it from slipping out, the whole being fixed to the stirrup; the other limb is bent upward to support the conductor. A special stirrup is designed for bends, one side being provided with a projecting arm in which there are several holes, for a tension wire to be connected, so that an inclined pull can be obtained at bends, making it possible to lay one conductor somewhat higher than the other, and so preventing the trolley from slipping off.—Lond. *Elec. Eng'ing,* July 6.

Design of Transmission Lines.—S. B. Wiggins.—A non-mathematical article discussing some of the essentials that must be considered in order to predetermine the characteristics of a transmission line. The features dealt with include line structure, insulators, conductor material, lightning protection and transformer connection.—*Michigan Technic,* June.

Electrophysics and Magnetism.

Duration of Electrical Contact.—A. E. Kennelly and E. F. Northrup.—The authors have made use of the Sabine method of measuring very small intervals of time by determining the loss of charge of a condenser of known capacity through a resistor of known resistance closed for the brief interval to be measured. Tests made by Dr. Kennelly in 1889 with a number of metallic spheres of different sizes and substances showed that the duration of contact was very nearly proportional to the ball's diameter at any given drop or height from which the ball fell upon an anvil, and the greater the drop the shorter the duration. In 1910 Dr. Northrup conducted tests which established the fact that the duration of contact varies inversely with the one-tenth power of the vertical drop and directly with the diameter of the ball. The harder the metals at their mutually impacting surfaces the shorter the duration. The duration is roughly about 20 per cent greater when a sphere impacts upon an anvil than when it impacts upon a stationary sphere of the same size. The suggestion is

made that the impacting sphere method may be employed for obtaining definite and predetermined small intervals of contact in electric circuits.—*Jour. Franklin Institute,* July.

Electrochemistry and Batteries.

Tungsten Concentration.—H. C. PARMELEE.—The second part of an article entitled "The Problems of Tungsten Concentration." In the present instalment descriptions are given of the apparatus and operation of mills for the treatment of old tailings and of mills for the treatment of ores. Among the mills described are those of the Primos Milling & Mining Company, of Smith & Ardourell and of the Wolf Tongue Mining Company. In the Lakewood (Col.) mill of the Primos Mining & Milling Company electricity is used both for lighting and motor service, all machinery being electrically driven.—*Met. and Chem. Eng'ing,* August.

The Metallurgy of Wrought Copper.—F. JOHNSON.—After outlining the recognized properties of copper as compared with other metals, the author discusses the phenomena which occur during the refining of copper and the effect of mechanical work on copper, and describes tests relating to the behavior of copper at high temperatures.—*Met. and Chem. Eng'ing,* August.

Electrically Controlled Constant-Temperature Water Bath.—H. C. GORE.—A brief outline with diagrams of an electrothermostat and an electromagnetically operated water valve for maintaining constant temperature in a water bath for an immersion refractometer. The thermostat consists of a mercury-column switch actuated by the heat of the water bath. The valve for admitting cooling or heating water to the bath consists of an ordinary electromagnetic sounder used in connection with a collapsible rubber tube.—*Jour. Ind. Chem. and Eng. Chem.,* July.

Units, Measurements and Instruments.

Plotting Hysteresis Curves.—R. CZEPEK.—An illustrated description of an instrument for plotting hysteresis curves which is a modification of the Ewing instrument. But, while in the latter adjustable direct current is employed, the author makes the test with commercial alternating current. As shown in Fig. 5, the curve is demonstrated

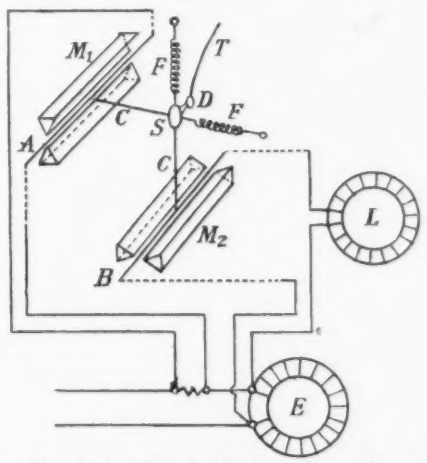


Fig. 5—Hysteresis Testing Apparatus.

by means of a light ray coming from an arc lamp and being reflected by means of a small mirror *S* which is mounted on the point of the support *D* and is deflected from its normal position by two wires *CF,* one being horizontal and the other vertical. One end of each of these two wires is coiled up in spiral form *F* and connected to a fixed point. The other ends of the wires *C* are connected with the wires *A* and *B* respectively, which move in horizontal and vertical directions respectively, between the poleshoes of the two electromagnets M_1 and M_2. Ewing's instrument is so arranged that the iron sample under test forms the legs of the electromagnet with the poleshoes M_2 and that the adjustable direct current which magnetizes the iron sample is also passed through the wire *A.* The field of M_1 is excited by the same direct current which passes through wire *B.* The horizontal oscillations of *A* are proportional to the magnetizing current; the vertical oscillations of *B* are proportional to the air induction of the magnetic circuit formed by iron sample, yoke and poleshoes. The author's instrument is quite similar, but all parts are made very small, as in an oscillograph, so that the characteristic oscillation period of the movable system is small compared with the period of the hysteresis curve to be plotted. M_1 and M_2 are the poles of two direct-current electromagnets. The wire *A* carries the magnetizing current (or a certain part of it), while the wire *B* carries an auxiliary current, the charge of which in time corresponds to that of the induction in the iron sample. This condition is fulfilled by making use of Degnione's method for plotting magnetic inductions with an ordinary oscillograph. The wire *B,* in series with an induction coil *L,* is connected to the terminals of the coil which magnetizes the iron sample *E.* The required condition, mentioned above, is then fulfilled, if the ratio of the ohmic resistance to the self-inductance *L* of the auxiliary circuit is sufficiently small. The wire *B* is part of the circuit which has the ohmic resistance *W* and inductance *L.* The rays from an arc lamp, reflected by the mirror *S* on a plane surface, produce directly the desired hysteresis loop curve.—*Elec. u. Masch.* (Vienna), April 23.

Bureau of Standards.—S. W. STRATTON.—A paper describing the work recently accomplished by the National Bureau of Standards, Washington, D. C., and that now under way.—*Proc. Eng. Soc. Western Penn.,* June.

Needle Galvanometer.—W. VOLKMANN.—A discussion of the most favorable arrangement of the coils and best dimensions of the wires for needle galvanometers.—*Ber. d. Deutsch. Phys. Ges.,* No. 4, 1911; abstracted briefly in *Elek. u. Masch.* (Vienna), May 7.

Telegraphy, Telephony and Signals.

Marine Telephone.—A short illustrated article on the Siemens loud-speaking telephone for marine service, the chief feature of which is that the loud tone is not obtained by the usual method of allowing large currents to pass through the microphone. The current in each microphone is about 0.07 amp. The instruments are arranged for working at 15 volts, which can be obtained either from the ship-lighting mains by means of a potentiometer resistor or from batteries. The microphone and telephone are constructed in a removable capsule form and are perfectly watertight.—Supp. Lond. *Electrician,* July 7.

BOOK REVIEW.

FACTORY ORGANIZATION AND ADMINISTRATION. By Hugo Diemer. New York: McGraw-Hill Book Company. 317 pages, 148 illus. Price, cloth, $3.

Until very recently it was generally supposed that science could be applied with success only to inanimate objects and processes. It was considered that a machine might be invented, developed, improved or repaired by the application of intelligence and science to the process and materials in which the machine was engaged and constructed. It was not considered that the same kind of intelligence or science could effectively be applied to the working of the machine for winning profits to the investor or securing comfort to the machinist who worked it. The book is a plea on behalf of the utility and economy of applying science to each step of factory production by the efforts and skill of trained engineers. It deals with the means of eliminating wastes and unnecessary labor, with the acceleration of output, the encouragement of the worker, the selection of the best sites, materials and markets for products. The book will commend itself both to factory owners and engineers.

New Apparatus and Appliances

EXHIBIT AT OHIO CONVENTION.

At the convention of the Ohio Electric Light Association, held at Cedar Point, Ohio, July 25 to 28, inclusive, a number of manufacturers displayed exhibits of their products on the lower floor of the convention hall. Among the exhibitors represented were the following:

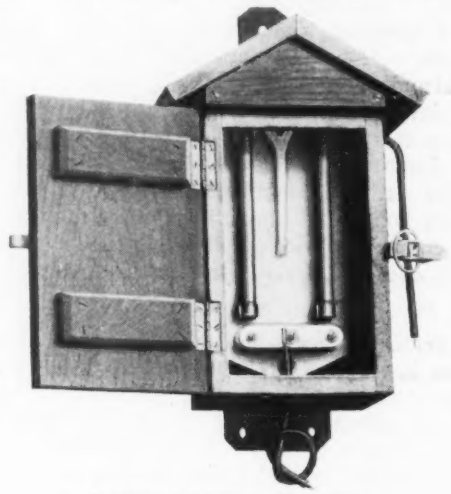
Adams-Bagnall Company, Cleveland, Ohio—Regenerative flame-arc lamps and Jandus fans. Allis-Chalmers Company, Milwaukee, Wis.—Steam turbines, transformers and motors. American Electric Iron Company, Detroit, Mich.—Electric irons. F. Bissell Company, Toledo, Ohio—Motors, time switches, charging sets, etc. Comet Electric Stove Company, Detroit, Mich.—Electric stoves and time switches. Crocker-Wheeler Company, Ampere, N. J.—Motors and transformers. Eclipse Electric Manufacturing Company, Chicago—Flat-rate controllers and sign flashers. Ft. Wayne Electric Works, Ft. Wayne, Ind.—Motors, meters and transformers. General Electric Company, Schenectady, N. Y.—Steam-flow meters, ozonizers, electric ranges, radiators, etc. Hart Manufacturing Company, Hartford, Conn.—Meter-protective devices. Hoover Suction Sweeper Company, New Berlin, Ohio—Electric sweepers. Hughes Electric Cookstove Company, Chicago—Electric stoves and ranges. Machado & Roller, New York—Electrical instruments and meters. W. N. Matthews & Brother, St. Louis, Mo.—Clamp guys, guy anchors, line switches, lamp guards, etc. Mica Electric Sign Company, Cincinnati, Ohio—Colored transparent signs. Northwest Electrical Equipment Company, Brooklyn, N. Y.—Meter-protective devices. Packard Electric Manufacturing Company, Warren, Ohio—Transformers, insulating varnishes, etc. Sangamo Electric Company, Springfield, Ill.—Watt-hour meters. Sterling Electric & Manufacturing Company, Warren, Ohio—Incandescent lamps. Wagner Electric Manufacturing Company, St. Louis, Mo.—Single-phase motors, unity-power-factor single-phase motor, battery-charging rectifiers, etc. Western Electric Company, New York—Lamps, washing machine, etc. Westinghouse Electric & Manufacturing Company, Pittsburgh—Tungsten lamps, transformers, fans, motors, circuit-breakers, etc.

OUTDOOR LIGHTNING ARRESTER.

Lightning arresters must protect apparatus not only against disturbances due to visible atmospheric discharge, but also against stresses caused by induction or surges on the line, or heavily charged clouds of rain or snow drifting across the line. So many and varied are the causes of disturbances and the different conditions under which apparatus must be protected that it is impossible to build a universal lightning arrester or one that will protect all apparatus on various kinds of circuits. It therefore becomes necessary to design arresters for different classes of service.

The Westinghouse Electric & Manufacturing Company has placed on the market a new design in its "Type G" lightning arrester for the protection of apparatus on alternating-current circuits having voltages not exceeding 2500 and power not exceeding 1000 kw. As will be seen from the accompanying illustration, the arrester consists of a series of air-gaps between non-arcing metal cylinders arranged in a row and connected in series with a graphite resistor. The cylinders and resistor forming the unit are mounted on a porcelain base, which, in turn, is mounted within a wooden box as shown in the accompanying illustration. In a two-pole arrester the unit is mounted on the back of the box, while with the three-pole and four-pole arresters two units are used, one mounted on each side of the box. On the three-pole style one of the resistor rods and its clips are omitted from the unit. The box is made of well-seasoned wood and is entirely weatherproof, enabling the arrester to be mounted out doors in any exposed location desired.

On a two-wire circuit the arrester has one wire connected to the top of each graphite resistor, and the ground wire is connected to the middle gap of the series. On four-wire circuits the same scheme of connections is used, but two units are necessary and the connections of both are the same. With three-wire circuits two units are used,



Outdoor Lightning Arrester.

and the connections are the same as for four-pole circuits except that there are but three line connections instead of four.

The operation of the arrester is as follows: If an excessive potential is developed on the line the electric discharge arcs from between the metal cylinders and the excess charge of electricity flows to ground, relieving the line of the excessive stress. The resistance offered to the flow of current by the carbon resistor prevents an excessive current passing through the arrester to ground, and the tendency for a destructive power arc to follow the discharge arc is thus counteracted. The arrester may be applied on circuits of which the sources of supply are capable of developing any amount of power.

MOISTURE-PROOF DRY CELL.

Where considerable moisture is prevalent it sometimes happens that the cardboard cartons of dry cells absorb so much moisture that when the cells are placed side by side or on a metallic base they run down and deteriorate quickly, thus necessitating frequent renewals and an attendant maintenance expense. The Western Electric Company, to obviate this, has recently placed on the market a moisture-proof dry battery. This cell has been designed especially for use in mine, railway and general telephone service where the batteries are subjected to moisture. The new cell has the same efficiency, life, voltage and recuperative power which characterize the standard "Blue Bell" battery. It differs from the standard cell in that the card-

board carton has been treated with a special impregnating compound which effectually prevents moisture from reaching the cell proper. This, it is claimed, will give sufficient protection so that the life of the batteries used in damp places will be as great as that of the batteries used in any other magneto service under ordinary conditions.

UNIVERSAL HOLDER SOCKET AND REFLECTOR UNIT.

The great attention given to illuminating engineering in the past several years has resulted in many improvements in the details of lamp fittings, shades and reflectors. An interesting example of this advance is furnished by a universal holder socket and a reflector now being placed on the market by the Adams-Bagnall Electric Company, of Cleveland, the two forming a unit to which the trade name "ABolite" has been given. The inventor is Mr. W. C. Hine, of Cleveland, who for many years has been prominently identified with the development of lighting fixtures,

Fig. 1—Cross-Section Showing Positioning Device.

Fig. 2—Ceiling ABolite for Glass Reflector.

and from whom the above-mentioned company has secured an exclusive license to manufacture and sell the new fitting and reflector.

Formerly shades and reflectors were designed with little or no reference to the proper focusing of the filament of the incandescent lamp inclosed. Moreover, with the introduction of the tungsten lamp the two standard sizes of bulbs of the carbon-filament lamp have been superseded by a number of shapes corresponding to the great range of ratings of the metallic-filament lamp. Owing to this latter consideration and to the scientific design of modern shades and reflectors, which design requires the filament to be properly focused, the use of a variety of socket shade-holder attachments has been necessary in order to secure the proper focusing of the filament within the shade or reflector.

The device here illustrated is designed to displace the unsatisfactory adjusting holders heretofore used. As will be seen by reference to Fig. 1, it includes a U-shaped positioning device inside the shell, carrying the porcelain socket or receptacle. When the positioning yoke is thrown down-

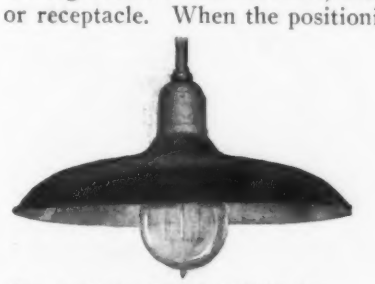


Fig. 3—18-In. Dome ABolite for 250-Watt Lamp.

Fig. 4—60-Watt Bowl ABolite.

ward, and the receptacle attached by its screws, the lamp is in a position corresponding to that given by an "O" shade-holder; and when the yoke is thrown upward, the position of the lamp is that corresponding to the use of an "H" holder. Another adjustment gives the position obtained with the "A" holder. With 2¼-in. universal holders lamps from 25 watts to 100 watts are used, 3¼-in. holders being suitable for lamps of 150 watts to 500 watts. One of each of the above sizes suffices for pendent fixtures and the same number for ceiling fixtures, thus obviating the necessity of carrying a diversified stock of fixture accessories.

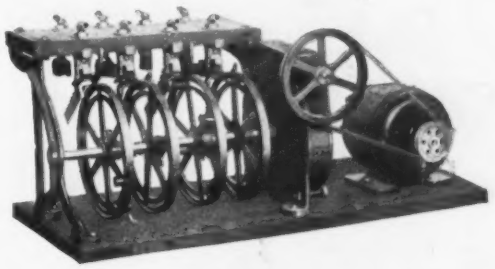
A complete "ABolite" unit consists of a universal holder socket and a scientifically designed steel reflector. The latter are made in a number of shapes, two of which are shown in the accompanying illustrations. The claims made for this unit are as follows:

1. The positioning device provides for three different positions of the filament with relation to a shade or reflector. 2. It eliminates the use of separable holders. 3. There is but one holder socket for all lamps from 25 watts to 500 watts. 4. All weight is borne by the holder socket. 5. The reflector can be removed for cleaning without disturbing the holder socket. 6. Either intensive or extensive illumination can be obtained by simply changing the positioning device. 7. A larger or smaller lamp unit can be substituted for another without replacing the holder socket.

A NEW ELECTRIC SIGN FLASHER.

The Reynolds Electric Flasher Manufacturing Company, of Chicago, has produced a new model in sign flashers, illustrated herewith. In this mechanism the switches are thrown in and out by purely mechanical action. By means of the slots in the wheels holding the rollers which engage a dog and throw the switch in and out, the latter can be shifted or set for long or short flashes. It is often necessary to make a minor adjustment in the flasher after the machine has been set up, and by means of the slotted wheels this can be easily accomplished—a feature that will be appreciated by most electricians who have occasion to install flashers.

In designing this flasher particular attention has been



Electric Sign Flasher.

paid to the roller bearings on which the worm-shaft runs. These are self-contained and require no oiling; the gear drive is inclosed and self-lubricating. There are no parts on the machine to wear out appreciably and the only parts which can burn out are at the switch blades and jaws. The latter are made and attached in such a manner that any person can replace them in a few minutes. Single, double and triple-pole knife-switch types are made.

The motor is mounted on the flasher base, belted, adjusted and ready to connect. The terminals and binding posts are of ample size and convenient, so that the electrical connections may be made readily. Care has been taken to make the machine of rugged construction. Flashers serve the double purpose of making the sign more striking and attractive and of saving electrical energy. The manufacturer of the machine herewith described makes a large variety of flashers, including those intended to produce fancy borders, lightning, crawling-serpent, rat-chaser, sky-rocket, fountain-and-flames, as well as to spell out words.

MOTOR-DRIVEN MACHINE TOOLS.

It is a recognized fact that the motor drive for machine tools is of great advantage, and this is especially so in the case of the two grinding machines shown in the accompanying illustrations. Fig. 1 shows a universal cutter and surface-grinding machine that readily grinds all forms of milling cutters ranging in size from 14-in. diameter, 6-in. face, down to the smallest. It will also do surface grinding, covering surfaces 6 in. wide by 9½ in. long. The spindle is of steel, hardened and ground, running in compensating boxes fully protected from floating emery. The motor used, which is a constant-speed machine of ⅓ hp at 1800 r.p.m., is bolted to the column of the machine, with suitable adjustment for keeping the belt under tension. The weight of the machine is 435 lb.

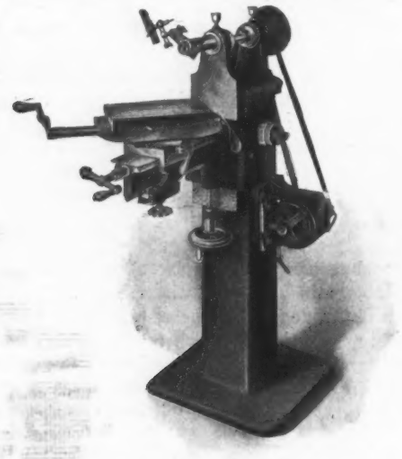


Fig. 1—Universal Cutter and Surface-Grinding Machine.

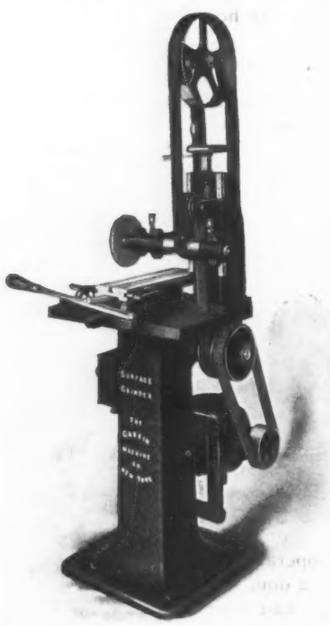


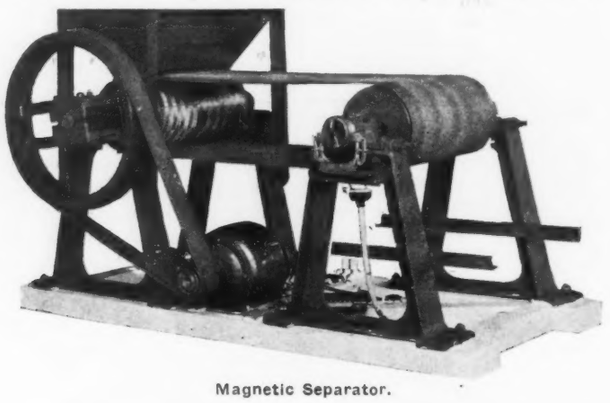
Fig. 2—Surface-Grinding Machine.

The surface-grinding machine, shown in Fig. 2, is a standard type with motor mounted on two steel arms bolted to the side of the column. A track for the motor enables the first belt to be adjusted to the proper tension. A looped belt driving to the spindle also has a compensating belt-tightening device. The motor is a constant-speed machine of ½ hp at 1650 r.p.m. The machine, which weighs 400 lb., will grind surfaces 7 in. wide x 9½ in. long and of a thickness from ⅛ in. to 6 in. The adaptation of motor drive is of special value to machines of this character, as they are commonly located in isolated places to which line shafting does not extend. Being portable, they can be set in any position, and having no countershafts they will not discolor the walls or ceilings. The power expense, of course, stops when the machine is idle. The above-described machines are made by the Garvin Machine Company.

MAGNETIC SEPARATOR.

The accompanying illustration shows an improved form of magnetic separator especially designed for removing steel or iron from coal, rock, ore, etc., on its way to be crushed, and for separating iron shot from molding sand, brass chips from machine-shop turnings, magnetic material from ores, etc.

The mixture to be separated is fed onto the moving belt, which runs at a speed of about 100 ft. per minute. The magnetic pulley at the right is made up alternately of steel-disk pole pieces and concentric windings energized through slip-rings outside the bearing. As the material to be separated passes over this pulley, the non-magnetic substances fall directly into a chute provided, while the magnetic material adheres to the belt and is carried further around and under the pulley, where it is precipitated into another hopper. The magnetic substances are thus delivered at a point widely separated from the non-magnetic matter. The magnetic pulley is made rugged and watertight by brass shells which inclose the coils between the poles. These pulleys are regularly built 12 in. in diameter and run at 60 r.p.m. The conducting slip-rings are fitted with self-adjusting carbon-brush holders. The separators have capacities for handling from 1340 cu. ft. to 3000 cu. ft. of material per hour, and are built with magnetic-pulley widths from 16 in. to 36 in., taking from 325 watts to 750 watts on any direct-current voltage. The magnetic pulleys may be furnished in diameters larger than 12 in. if desired. These magnetic separators are built by the Cutler-Hammer Clutch Company, Milwaukee, Wis.



Magnetic Separator.

RUN ON ELECTRIC FANS IN BOSTON'S HOT SPELL.

Unprecedented heat in Boston, exceeding all records both in severity and duration, stimulated electric-fan business to an amazing degree. The dealers say that the stock there has been completely exhausted; hardly a fan can be bought in the city to-day. The Edison company has never before experienced anything like the volume of business in that line. It sold more fans during the week of July 3-8 than all of last summer, and could have sold a thousand more during that week and the week following if it could have met the demand. The call is especially heavy for alternating-current fans, for use in the suburbs and country districts. The Edison company has also had an unusual demand for electric ranges and complete cooking outfits.

H. S. Potter, an electrical supply dealer at 24 Commerce Street, spent an hour and a half at the long-distance telephone trying to secure a shipment of electric fans from manufacturers. Finally he was able to secure from a New Jersey concern an invoice which came by express and filled two large delivery wagons. The goods never reached

his store, but were delivered direct to customers by the express company as soon as they reached Boston.

Pettingell-Andrews Company, a large supply house, reports, by Mr. S. W. Carter, head of the department, that the supply of 12-in. alternating-current, 110-volt fans was exhausted in record time; the 12-in. direct-current were in not quite so brisk demand, but were quickly taken, and other sizes are now all sold. This firm's orders for fans were ten to fifteen times those of normal years, and the force has been kept busy constantly since July 3 either supplying orders or, later, pacifying customers who could not be supplied. The firm had an overstock of electric fans at the beginning of July, and had decided that the season's business in that line was over, when the change of temperature resulted in upsetting calculations. The Seth W. Fuller Company, Stuart, Howland Company, and other dealers, report like conditions.

It is to be noted that in spite of the abnormal demand prices have been kept down to the regular standards, both by the retailers and the jobbers.

DUPLEX WELDING MACHINE PANEL.

The accompanying illustrations show a duplex welding machine panel built by the Automatic Switch Company, New York City, for use in connection with two 300-amp, 45-volt generators. There are five graduated resistors in series with each of the welding tools and also three banks of resistors, which are cut in across the generator circuit when the welding tool is not in contact. This latter operation is performed automatically by means of a relay and a Darrin magnet switch, shown in the center of the panel. The panel is equipped in addition with a voltmeter and ammeter with double-throw switches to permit the use of either on either generator. There are also a field regulator, double-pole, main-line switch with fuses, tubular resistance shown at the base of the panel in front view, and grid resistance back of the panel for the heavier currents in the welding circuit.

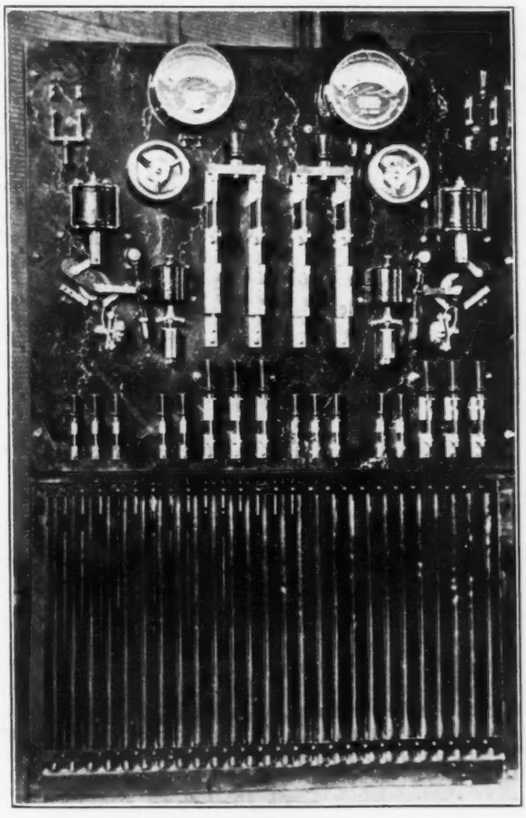


Fig. 1—Front View of Welding Machine Panel.

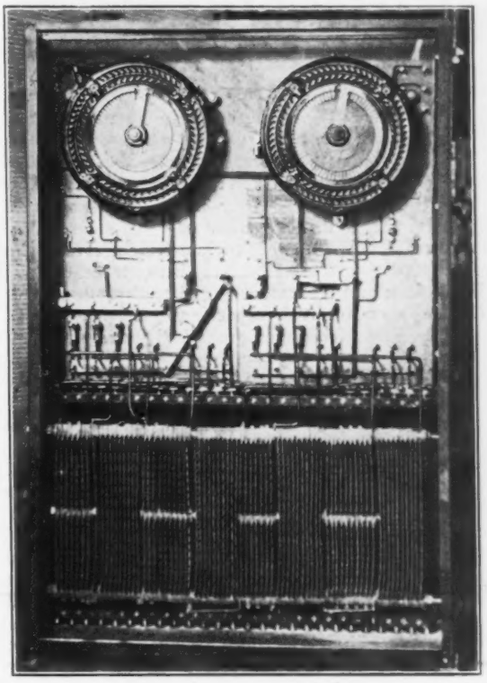
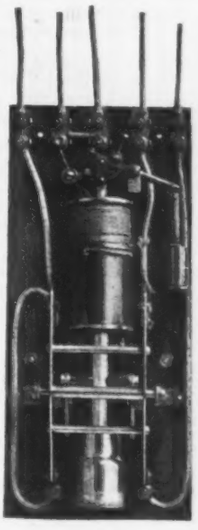


Fig. 2—Rear View of Welding Machine Panel.

MOTORLESS SIGN FLASHER.

The sign flasher shown in the accompanying illustration avoids the cost and disadvantage of a motor-driven device, and requires the minimum of energy for its operation. The flasher, made by the Eclipse Electrical Manufacturing Company, 418 Milwaukee Avenue, Chicago, is in general construction similar to the flat-rate controller made by the same company. The series coil of the controller, however, is replaced by a shunt winding which lifts its core against gravity, closing the circuit to the shunt solenoid which operates the switch. The entire device is immersed in oil, which insulates the parts and prevents sparking at the switch contact. Flashers of this type for either direct current or alternating current can be supplied. The device illustrated is designed for operating successively the two sides of a double sign. Its period of operation can be adjusted by means of the set screw at the top. The flasher mechanism is of polished brass, mounted on ebony-asbestos board, and enamel insulated wire is used in the coils. The solenoid mechanism is insulated from the switch parts by fiber connections. As the controlling force utilized to restore the switch is gravity, there are no springs to weaken or change adjustment with time. The switch mechanism is designed to break up to 20 amp, but the period of operation of the solenoid remains unaffected by the number of lamps connected under the switch. The solenoid is said to be very economical in operation.



Motorless Sign Flasher.

Industrial and Commercial News

The Week in Trade.

DEVELOPMENTS in the business situation indicate that gradual improvement is being made. Output in many lines of industry is being increased, orders for future delivery are on a slightly broader scale, and fewer cancellations are reported from sections where crop prospects were not especially bright in the earlier part of the season. Substantial decrease in the number of idle freight cars is a further sign of the larger volume of business being transacted. Operations in the iron and steel trades are broadening, and many of the mills are increasing their capacity to meet new orders. Reduction in the price of finished products is believed to be forthcoming, with a view to expanding the buying movement, and prospects are good for increased business in August and September. During the week the Standard Oil Company gave official notice of its plan for meeting the dissolution order of the Supreme Court, and the American Tobacco Company issued copies of the bondholders' agreement under which a readjustment plan will be effected. Stockholders of the Standard Oil Company of New Jersey were notified that they will receive a pro rata interest in the stocks of the thirty-three companies owned by the parent company which were co-defendants in the suit to dissolve the trust. Various oil and gas properties owned by the Standard Oil Company of New Jersey will be operated by the latter as a manufacturing company. Improvement in the West shows no signs of abatement, and expectations are general for business revival in the fall. News of crop conditions is encouraging, reports showing cool weather and sufficient moisture, and there is a feeling of confidence that yields will be at least up to the average. There is every reason from the present standpoint to strengthen the belief that the record of the second half of the year will be more satisfactory than was that of the first. Business failures for the week ended July 27 were 241, as compared with 239 for the previous week, 200 for the same week in 1910, 223 in 1909, 275 in 1908 and 142 in 1907.

The Copper Market.

NOTHING of importance occurred last week to cause any change in the stagnation of the copper trade. The tone of the market was decidedly weak, and demand from both foreign and domestic consumers was light, while prices were more nearly upon a 12¼-cent basis than upon the recent 12¾-cent scale. The majority of sales were made by second hands, as most of the larger producers remained out of the market in the belief that the July report of the Copper Producers' Association will be favorable to the trade and prices will advance. Business will probably be on a limited scale until the report is made public. Orders for finished material showed no increase during the week. Announcement by the Metal Exchange that trading in electrolytic copper in addition to standard contracts would be in order after Aug. 1 was a feature of the week, being of interest to small consumers in the interior, whose dealings are largely through second hands. Action was deferred on that date, however, by the exchange and there is a possibility that the sale of electrolytic copper on call will be further postponed. Estimates of July business place total deliveries at 135,000,000 lb. to 140,000,000 lb., with 75,000,000 lb. of this for export, and indicate that the reduction in surplus stocks will approximate 15,000,000 lb. Exports for the month of July were 34,955 tons. The daily call on the Metal Exchange, Aug. 1, quoted copper as per the accompanying table.

Standard Copper	Bid.	Asked.	Settling Price.
Spot	12.12½	12.20	.....
August	12.12½	12.25	12.20
September	12.15	12.25	12.20
October	12.15	12.25	12.20
November	12.17½	12.25	12.22½

The London market, Aug. 1, was as follows:

	Noon. £	s	d	Closing. £	s	d
Standard copper, spot	56	5	0	56	2	6
Standard copper, futures	56	17	6	56	15	0

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard	12.35c.			11.57½c.		
London, spot	£57	10	0	£53	7	6
London, futures	58	2	6	54	0	0
Best selected	61	10	0	57	5	0

Industrial and Commercial Notes.

Arbitration of Business Controversies.—The Chamber of Commerce of New York State has instituted a system of commercial arbitration for the settlement of business controversies, thus returning to a line of work which enhanced the usefulness of the chamber during more than a century of its existence, namely, from 1768 to 1874. This arbitration service is not limited to the adjustment of differences between members of the chamber, nor even residents of New York, but is freely offered to the entire business world, subject only to the right of the committee to determine whether the character of any specific controversy is such as to come within the scope of cases acceptable for arbitration. The list of official arbitrators appointed consists of about 200 members of the chamber, who have accepted appointment in the spirit of serving a public end. The disputants have various choices in the selection of arbitrators, as they may choose one individual as sole arbitrator; or they may select two arbitrators, not necessarily members of the Chamber of Commerce, who in turn shall designate a third person from the list of official arbitrators; or they may call for arbitration service by the committee of arbitration of the chamber or a quorum thereof. The expense of this arbitration is very small as compared with the cost of similar litigation in an ordinary court of law, while complications due to purely legal technicalities do not intervene. In order to prevent the submission of trifling cases a fee is charged, but this is in all instances practically nominal, consisting of a fee of $10 a day for each arbitrator and payment for stenographic service at the usual market rate. Owing to the number of names on the list of arbitrators, numerous cases can be carried on simultaneously, thus leading to prompt consideration of controversies submitted for arbitration. An award by the Chamber of Commerce arbitrators has the force of a verdict by the Supreme Court of the State of New York.

Present Management Retains Control of Westinghouse Company.—The contest between former President Westinghouse and the administration for control of the company resulted at last week's meeting in victory for the present management on all points of contention. The following directors were elected: James S. Kuhn, Edwin M. Herr, Charles F. Brooker, Edwin F. Atkins and Harrison Nesbit, who is to complete an unexpired term. Resolutions of the Westinghouse faction calling for annual election of directors and for cumulative voting were not passed. At an organization meeting of the directors, held in New York on Aug. 1, Edwin M. Herr was elected president of the company, succeeding Edwin F. Atkins, who had requested to be relieved of the office, which he had accepted a year ago with the understanding that the appointment would be temporary. Robert Mather was re-elected chairman of the board. Other elections were as follows: Vice-presidents, L. A. Osborne, Charles Terry and Harry P. Davis; acting vice-presidents, George W. Hebard and H. D. Shute; comptroller and secretary, James C. Bennett; treasurer and assistant secretary, T. W. Siemon; assistant secretary, Warren H. Jones; assistant treasurer, H. F. Baetz; acting assistant treasurer, S. H. Anderson; auditor, F. E. Craig; assistant auditor, W. B. Covil, Jr. Calvert Townley has been appointed assistant to the president.

General Vehicle Electric Trucks for the Navy.—The Navy Department has ordered eight 5000-lb. trucks from the General Electric Vehicle Company, one of which will go to the island of Guam and the others to the navy yards at Boston, New York, Norfolk, Mare Island, Philadelphia, Charleston and Bremerton.

Field for Electrical Supplies in Valencia, Spain.—A consular report, describing industrial conditions in Spain, says that the lighting of the city of Valencia will soon bear favorable comparison with that of any of the large cities of the world and that electric power has been extended to all tramway traffic except in very narrow streets in the older sections of the city. The report says, further, that the demand for gas and steam engines is declining, and that many of the rice-hulling and cleaning mills, steel works and lumber mills and most of the new industrial enterprises are now using electricity in place of all other forms of motive power. The price of electricity for power purposes within the city limits, where competition between central-station companies is active, is about 3 cents per kw-hour for large consumers, and in outlying townships, where only one source of supply is available, the cost is 8 cents to 10 cents per kw-hour. The development of the electrical industry in the country offers a wide field to manufacturers of electrical equipment. Most of the trade in Valencia is being secured at present by branches which two foreign electrical firms have established in the city. The report states that competition in tungsten and metallic-filament lamps was so extreme in 1910 that the leading makes of lamp from 16 cp to 50 cp, with a guaranteed minimum life, were sold to agents at the equivalent of 27 cents each, freight and duty paid, if of foreign manufacture. Two types of lamp are now being produced by Spanish factories, one at Madrid and the other at Barcelona. The duty on imported lamps is $1.54 per kilo (2.2 lb.) or approximately twenty to twenty-five lamps unmounted.

Foreign Company to Deal in American Securities.—The Société Financière de Valeurs Américaines has been organized in Brussels with a capital of 30,000,000 francs, to invest principally in railroad, traction and electrical securities in North and South America, and in state and city bonds of South American countries. Among the banking interests that assisted in the formation of the company are Kuhn, Loeb & Company, of New York; the Banque de Bruxelles; the Banque de Paris et des Pays-Bas; the Société Générale de Belgique, Brussels; the Deutsche Bank, Berlin; F. M. Philippson & Company, Brussels; M. M. Warburg & Company, Hamburg; Arthur Spitzer & Company, Paris; the Société Générale pour Favoriser, Paris; the Société Française de Banque et de Dépôts; the Banque Française pour le Commerce et l'Industrie, Paris, and Robert Fleming & Company, of London. Baron Janssen, of the Société Générale de Belgique, is named as chairman of the board of directors and Consul Franz Philippson as vice-president. M. M. Warburg, of Hamburg, and Mortimer L. Schiff, of New York, are members of the board.

New York Edison's New Building.—The offices of the Second District of the New York Edison Company are now located temporarily at 245 West Forty-second Street, New York City, the former offices at 124 West Forty-second Street having been vacated in order to tear down the old building and prepare for the new structure mentioned in the issue of July 1. The construction department of the company is sinking drills from the basement of the old building in search of bed rock, but up to a short time ago at a distance of 17 ft. had encountered nothing but dirt. The plot on West Forty-second Street is 25 ft. x 100 ft. and the new building when completed will contain the offices of the district and the entire contract and inspection departments.

New Electric Road for Washington State.—Articles have been drawn by A. E. Mead, ex-Governor of Washington, for the incorporation of the Bellingham, Mount Baker & Spokane Interurban Railroad Company. The company is to be capitalized at $22,500,000, and is to build an electric road from Bellingham to Spokane, a distance of nearly 290 miles. It is said that London capitalists are interested in the undertaking. The incorporators include the following: Joseph Morrison, president Morrison Mill Company; A. E. Mead, Bellingham; F. Peace, Vancouver, B. C.; W. L. Hart, Blaine; A. C. McLean, Seattle, and C. E. Wingate, Tilden, Wash.

Long Acre Company Authorized to Issue Bonds.—The Public Service Commission for the First District of New York has granted the application of the Long Acre Electric Light & Power Company to issue additional bonds. The commission authorizes the company to make the new mortgage for $50,000,000 referred to in the *Electrical World* July 15, and under this mortgage to issue stock certificates to the amount of $2,000,000 and bonds to the amount of $4,000,000. The plan sanctioned by the Public Service Commission permits the company to sell $2,000,000 of bonds when it has had $1,000,000 new stock subscribed and paid for, and an additional $2,000,000 when another $1,000,000 of stock has been paid for. The commission orders further that the new mortgage may be made only when a former mortgage authorizing an issue of $1,000,000 bonds has been either canceled or subordinated to the mortgage just authorized. The proceeds of the new bonds will be applied as follows: For the acquisition of new property and the construction, completion and extension of its plant and distribution system, $3,400,000; for the discharge of existing obligations, $200,000; for discount and expenses of the sale, $400,000. J. F. Shaw, president of the Long Acre Electric Light & Power Company, said on Wednesday: "Our engineers are at work on methods for generating the energy required, but just what method will be employed it is not possible to state now. We may purchase waste surplus energy from one of the electric railway systems in the city and charge storage batteries, or we may erect a station in Pennsylvania and transmit energy by high tension to New York City, or we may do both, or we may erect a station on the East River. I venture to say that we can obtain all the energy we want from the surplus capacity of any one of the electric railway systems of the city for 1¼ cents per kw-hour. We have not filed any new schedule of rates with the Public Service Commission in New York, but I may say that our rates will be lower than those of the New York Edison Company. I have no doubt that a representative of a central-station company could, in competition with the New York Edison Company, go out and sell just as much energy as he wants at the same rates as are now charged by the New York Edison Company. Inasmuch as our rates will be lower, it is probable that we will get a fair amount of business." In answer to a question as to the probable outcome of competition with the New York Edison Company, Mr. Shaw said that it is, of course, impossible to predict at this time what the future will bring forth. "Possibly in twenty years we may be purchased by the New York Edison Company, but, on the other hand, we might purchase it. There are several cases where the smaller company has purchased the larger. It is probable that we will be in active operation within the next three months."

Blewitt Falls Hydroelectric Development.—The Yadkin River Power Company has placed an order with the General Electric Company for three 6000-kw water-wheel driven, 4000-volt generators; five 3-phase 6250-kw transformers, 4000-100,000 volts, and four 2500-kw transformers, 4000-22,000 volts. The former transformers are for stepping up the generating voltage to the transmission-line voltage of 100,000, while the latter are for stepping up the voltage to 22,000 for local distribution. The above apparatus is for use in the generating station at Blewitt Falls on the Yadkin River. In addition to this apparatus the order covers a large amount of switching and miscellaneous apparatus for a complete 30,000-hp generating station. The North State Hydroelectric Company, subsidiary to the Carolina Power & Light Company, which is to distribute the Blewitt Falls energy, has purchased for its switching and substation at Method four 2750-kw, single-phase transformers for stepping the voltage down from 100,000 to 60,000 volts, with complete equipment of switches, etc.; also, three 1250-kw, single-phase, water-cooled transformers for the Henderson substation, for stepping the voltage from 60,000 to 22,000 volts for distribution at Henderson.

Stock-Selling Licenses in Kansas.—According to a new law, popularly known as the "blue-sky" law, shares of stock can only legally be sold in Kansas after a license for selling has been procured from the State Banking Department. Licenses are issued only after an investigation showing that the stock approved is a sound investment. Within a few weeks after the passage of the law by the Legislature more than 300 applications for licenses were filed, of which thus far only eighteen have received favorable action.

New Receiver for Wireless Company.—Supreme Court Justice Seabury has signed an order accepting the resignation of Sidney Harris as receiver of the United Wireless Company, and has directed him to deliver all assets of the company to Selden Bacon, who is receiver in bankruptcy.

Aluminum Notes and Prices.—The market for aluminum is dull, with ingots for remelting held at 21@21½ cents spot No. 1, the base for large ingots. Rods and wire are held at 31 cents and sheets at 33 cents, prices being those of Aug. 1.

Financial.

The Week in Wall Street.

SECURITIES have been influenced to some extent by numerous matters of importance which have taken place both in this country and abroad. The latter part of the past week was characterized by irregularity, and the tendency inclined toward lower prices, but the quotations of most of the more active issues were but slightly changed at the close on Saturday. Much of the irregularity was due to the critical aspect of the Moroccan controversy, which resulted in sharp selling of stocks for foreign account, and by weakness on exchanges abroad. British consols dropped to 77¾, a record figure. The passage of the Canadian reciprocity act and the report of earnings of the Steel Corporation had no great effect upon the stock market, since the scope of both had been anticipated. Trading on Monday was light, but the tone of the market was strong throughout the day. Prices were irregular and highest in the last hour, and new records were made in Bethlehem Steel shares. Announcement on Monday of the plan of the Standard Oil Company for dissolving in compliance with the ruling of the Supreme Court was not a leading factor in the prices for the day. Business on Tuesday was on a very narrow scale, and prices were unsettled. Reports of monthly earnings of a number of important railroads were probably of more influence upon the market than any other incident of the day, showing losses in gross and net earnings, and efforts to offset losses in gross by curtailment of operating expenses. More rumors were in circulation during the day of the possibility of an investigation into monetary conditions in Wall Street, and the incident was attributed to political action. The financial situation of the early past week was marked by the remittances to banks in the harvesting districts and withdrawals of gold for Canada, and the financing of the cotton crop will, before long, become a matter of moment. The effect of the remittances was a slight hardening of rates in the money market, but ease is still apparent, despite the broadening of demand. Rates Aug. 1 were: Call, 2¼@2½ per cent; ninety days, 3¼@3½ per cent. The quotations in the tables are those at the close Aug. 1.

NEW YORK.

	July 25.	Aug. 1.	Shares sold.		July 25.	Aug. 1.	Shares sold.
All. Ch.....	8½*	8½*	———	Int. Met., pf.	51	49½	7,550
All. Ch., pf...	28*	28	———	Mackay Cos..	86½*	86	100
Amal. Cop...	68	66¾	20,750	Mackay C.,pf.	74½*	74	———
Am. D. T....	20½*	20½*	———	Man. Elev...	139*	139*	100
Am. Loco...	40¾*	40	800	Met. St. Ry..	15*	15*	———
Am. Loco., pf.	108*	108	200	N.Y.&N.J.Tel.	139½*	139½	———
Am. Tel. & C.	80*	79¾	———	Steel, com...	79⅜	79⅞	192,877
Am. T. & T.	136½*	136⅜	12,600	Steel, pfd....	119	118	4,063
B. R. T.....	82⅛	81	13,300	W. U. T....	80	79⅝	2,450
Gen. Elec...	163½	162¼	2,690	West'h, com.	75	73	4,100
Int. Met....	18⅛	17½	3,000	West'h, pfd..	119*	118¼	100

PHILADELPHIA.

	July 25.	Aug. 1.		July 25.	Aug. 1.
Am. Rys.....	44	44½*	Phila. R. T.....	22¼	23¾
El. Co. of A.....	12¼*	11⅞*	Phila. Elec.....	17¾	17⅞
Elec. St. Bt'y.....	55¼	55	Phila. Trac.....	86¾*	86½*
Elec. St. Bt'y., pf...	30*	30*	Union Trac.....	52¼	52½

CHICAGO.

	July 25.	Aug. 1.		July 25.	Aug. 1.
Chi. City Ry.....	186*	186*	Com. Edison.....	135⅞	135⅞
Chi. Elev. Rys.....		26½	Chi. Subways.....	4	3⅝
Chi. Elev. Rys.....		93	Chi. Tel. Co.....	123	123*
Chi. Rs., Ser. 1....	97*	100	Nat'l Car.....	112½	113
Chi. Rs., Ser. 2....	28¼	32⅞	Nat'l Car, pfd.....	118½*	118½*

BOSTON.

	July 25.	Aug. 1.		July 25.	Aug. 1.
Am. T. & T.....	136⅝	136⅜	Mex. Tel.....	4*	4*
Cum. Tel.....	157⅜	157⅝	Mex. Tel., pfd.....	6¾	6*
Edison E. Ill.....	285*	287	N. E. Tel.....	146	146
Gen. Elec.....	163	162½	W. T. & T.....	21½	20¼
Mass. E. Ry.....	22⅞	22¼*	W. T. & T., pfd....	98½	99*
Mass. E. Ry., pf....	93	93			

*Last price quoted.
Shares sold for the week, July 24 to July 29.

Financial Notes.

Organization of American Cities Company Completed.—The American Cities Company went into permanent organization in New Orleans on July 25, 1911, and now controls the street-railway and lighting systems of New Orleans, Birmingham, Knoxville and Little Rock, the electric railway systems in Memphis, and the electric lighting companies in Houston. Its capitalization is $10,000,000 in collateral trust bonds, $21,810,083 preferred stock and $16,643,416 common. The officers are: George H. Davis, of Ford, Bacon & Davis, president; George Bullock, of New York, and W. Von Phul, of New Orleans, vice-presidents; M. McGrath, secretary; R. E Slade, manager of the New Orleans Railway & Light Company, treasurer and assistant secretary; Ira Lockwood, assistant treasurer and assistant secretary; Charles K. Beekman, general counsel. The board of directors is as follows: George W. Bacon, member of the firm of Ford, Bacon & Davis, New York; George Bullock, president Susquehanna Railway, Light & Power Company, New York; S. R. Bertron, member of Bertron, Griscom & Jenks, New York; E. H. Bright, member of T. & B. Beer, New Orleans; Harry Bronner, member of Halgarten & Company, New York; William B. Bonbright, of William B. Bonbright & Company, New York and London; Lynn H. Dinkins, president Interstate Trust & Banking Company, New Orleans; Marshall J. Dodge, member of Bertron, Griscom & Jenks, New York; George H. Davis, member of Ford, Bacon & Davis, New Orleans; C. P. Ellis, cotton broker and banker, New Orleans; C. L. Edwards, of A. G. Edwards & Company, bankers, St. Louis; Oscar L. Gubelman, of Knauth, Nachod & Kuhne, New York; John J. Gannon, president Hibernia Bank & Trust Company, New Orleans; R. M. Gannon; Charles Godchaux, president Whitney-Central Trust & Savings Bank, New Orleans; Frank B. Hayne, cotton merchant, New Orleans; A. J. Hemphill, president Guaranty Trust Company, New York; C. J. Hardy, temporary, pending return of C. E. Allgeyer to New Orleans; Charles Janvier, vice-president Canal-Louisiana Bank & Trust Company, New Orleans; Emil Loeb, capitalist, Birmingham and New York; Fernand Lapeyre, capitalist and stock broker, New Orleans; S. Z. Mitchell, president Electric Bond & Share Company, New York; J. K. Newman, of Isidore Newman & Son, New Orleans; Maurice Stern, of Lehman, Stern & Company, New Orleans; L. K. Thompson, vice-president Bank of Commerce & Trust Company, Memphis, Tenn.; William von Phul, of Ford, Bacon & Davis, New Orleans; R. M. Walmsley, president Canal-Louisiana Bank & Trust Company, New Orleans; F. B. Williams, vice-president Whitney-Central National Bank, New Orleans; A. H. Wiggin, president Chase National Bank, New York. The Whitney-Central Trust & Savings Bank, of New Orleans, was appointed transfer agent, and the Hibernia Bank & Trust Company, of New Orleans, registrar. The connection of William von Phul with the company will more actively renew his associations with New Orleans electrical people whom he knew in 1899 when general superintendent of the Edison Electric Company of that city. President Davis stated that no changes were contemplated in the local management, with the exception of the appointment of D. A. Hegarty, of Little Rock, to a technical and executive position in the New Orleans Railways Company.

Empire Gas & Electric Bonds Offered.—Francis Ralston Welsh, of Philadelphia, is offering $1,300,000 joint first and refunding mortgage 5 per cent gold bonds of the Empire Gas & Electric Company and the Empire Coke Company. The Empire Gas & Electric Company is a consolidation of all the companies supplying electric light and power in Auburn, N. Y., and all the companies supplying gas in Auburn, Geneva, Seneca Falls and a number of other localities in this section of New York State, and the Empire Coke Company manufactures gas, coke, etc., and sells its gas to the Empire Gas & Electric Company. The issue constitutes a direct first-mortgage lien on all the properties of the Auburn Light, Heat & Power Company and the Auburn Subway Electric Company, and a collateral trust first lien on the property of a number of the gas companies in the cities mentioned. Provision is made for a betterment fund equal to 2 per cent of all bonds of this issue outstanding, to be spent for additions and betterments to the properties. The bonds are offered at 97½ and interest, to yield about 5.16 per cent, and are callable at 102 and interest on March 1, 1914, or any interest day thereafter. They are tax exempt in the State of New York, and have been approved by the Public Service Commission for the Second District of New York.

Hall Signal Company to Reorganize.—Contracts aggregating $125,000 were closed during the week by the Hall Signal Company with a number of railroad companies, making the total of unfilled orders on the books of the company close to $575,000, the largest amount of unfilled orders on hand for a number of years. The reorganization committee is making plans for meeting the $100,000 indebtedness which is due very shortly, and for reorganization of the company.

Texas Telegraph Controversy.—Further developments in the strained situation between the telegraph companies operating lines in the State of Texas have brought forth a letter from C. C. Adams, vice-president of the Postal Telegraph-Cable Company, of New York, to J. P. Lightfoot, Attorney-General of Texas, in which the relations of the competing companies are reviewed, and the allegation made that Bell interests are seeking to create a monopoly in Texas and suppress competition in that State by combination and absorbing companies with which the Mackay interests have been long associated. The letter refers to the formation of the Postal Telegraph-Cable Company of Texas, whose line connected with those of the Mackay system, and says that the Bell Telephone Company, in order to use the poles of the Texas Postal company for extension of its telephone system, purchased the entire capital stock of this company. Relations between the Bell and Mackay interests were amicable until the former purchased control of the Western Union, which is the greatest competitor of the Mackay system. The latter interests then stated that they could not, either from a business or legal standpoint, tolerate a condition where the Western Union and the Texas Postal were under the same control, terminated their contract with the Texas Postal and are building their own lines in the State. Since Bell interests retain the name Postal Telegraph & Cable Company of Texas, the Mackay interests have called the Texas company which they are now developing, and whose lines are scheduled to reach Galveston and Houston by Sept. 1, the Mackay Telegraph & Cable Company. The statement is made that the Bell company has absolute control of the board of directors, executive committee, policy and operation of the Western Union company, and description is given of the negotiations between English cable companies and the head of the Western Union company for control of submarine cables by the American company. The letter says in part: "The Mackay interests are entirely able to take care of themselves and are strongly intrenched in finances, organization and fast service, and are not afraid of what seems to be the crushing-out campaign of the combine. That combine is approaching its Waterloo in its finances. It is well, however, for the American people to realize that the American Telephone & Telegraph Company is apparently seeking an absolute monopoly in ocean cables and land-line telegraph and telephone communication in the United States. It is already far on the way and it will keep right on relentlessly until stopped by the federal and state governments."

Earnings of Mexican Tramways Company.—A surplus available for dividends amounting to 8.59 per cent on its $16,487,400 outstanding capital stock was earned by the Mexican Tramways Company in the year ended June 30. This compares with 5.59 per cent earned in the previous year on the same amount of stock, and with 8.03 per cent on the $11,487,400 stock then outstanding. Gross earnings increased slightly over $600,000. During the year the company issued and sold 50,000 shares of capital stock, the proceeds of which provided funds for various purposes, which included a number of extensions and advances to the Mexican Light & Power Company, Ltd., to assist in the hydroelectric developments that are being constructed by the latter company. The properties of the Tramways company are reported in good condition as a result of the expenditure of $700,000 for maintenance. The financial statement of the company, as of Dec. 31, showed cash on hand, $729,936, as compared with $529,802 for the previous year; total capital stock outstanding, $16,487,400, as compared with $11,487,400; cost of property and securities to Dec. 31, $21,071,815, as compared with $20,880,240; and advances to and from subsidiary companies, $14,358,657, as against $10,695,940 for the previous year.

New York, Westchester & Boston Bonds Sold.—Kissel, Kinnicut & Company and Harris Forbes & Company have sold the $17,200,000 first mortgage 4½ per cent gold bonds of the New York, Westchester & Boston Railway Company, to which reference was made in the last issue. The company is a subsidiary of the New York, New Haven & Hartford Railroad Company, and is building a four-track elevated road from 138th Street, New York City, to Port Chester, N. Y. The bonds were offered at 96¼ and interest, to yield over 4.70 per cent, are tax exempt in New York State and have been approved by the Public Service Commission for the Second District of New York. In the circular describing the issue, the summary of a letter by C. S. Mellen, president of the New York, New Haven & Hartford Railroad Company, states that the payment of principal and interest of the bonds is unconditionally guaranteed by indorsement upon each bond by the New York, New Haven & Hartford Railroad Company, which holds practically the entire capital stock of the New York, Westchester & Boston Railway Company, and states further that the net income of the guarantor for the fiscal year ended June 30, 1910, above operating expenses, taxes, rentals and all interest charges, was $10,796,874. In addition to the guarantee of the New York, New Haven & Hartford Railroad Company, the letter says that the bonds are secured by a direct first mortgage on the entire property of the New York, Westchester & Boston Railway, which represented on May 31, 1911, an investment by the parent company of $25,647,004. Applications for these bonds were largely in excess of the amount offered. Application will be made to list them upon the New York Stock Exchange.

Massachusetts Electric Companies.—In the fiscal year ended June 30, 1911, gross earnings of the Massachusetts Electric Companies were $8,881,520, representing an increase of $434,458 over the returns of the previous year. This figure is favorably regarded in view of the dullness in the territory throughout the year and the fact that many of the mills in the section were either closed or operated on partial time. Operating expenses increased $340,735, and an increase of $72,531 was made in charges and taxes, and the surplus available for dividends increased $21,191, aggregating $1,485,886, the largest total for this purpose in the history of the company. Earnings in the past fiscal period were at the rate of nearly 6½ per cent on the $20,557,400 outstanding preferred stock. The company now supplies electric service to some 100 towns and cities in New England, and the book value of the properties is placed at $49,500,000.

Ft. Worth (Tex.) Power & Light Company.—J. R. Nutt, of the Federal Telephone & Telegraph Company, announces that he and others are the incorporators of the Ft. Worth Power & Light Company, with a capital stock of $3,560,000, to take over the lighting business which has for some time been conducted there by Mr. Nutt individually. All of the capital has been paid in. Mr. Nutt explained that he had simply decided to incorporate the business and that the other men interested are friends in the bond business.

DIVIDENDS.

Boston Elevated Company, semi-annual, 3 per cent, payable Aug. 15.

Connecticut Railway & Light Company, quarterly, preferred and common, 1 per cent; both payable Aug. 15.

Detroit United Railway Company, quarterly, 1¼ per cent, payable Sept. 1.

Mobile (Ala.) Electric Company, quarterly, preferred, 1¾ per cent, payable Aug. 15.

Tampa Electric Company, quarterly, $2.00 per share, and extra dividend, $1.00 per share, both payable Aug. 15.

REPORT OF EARNINGS.

CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.

Period.		Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
June,	1911	$606,027	$356,844	$249,183	$50,044	$199,139
"	1910	565,162	319,407	245,755	48,221	197,534
6m., June,	'11	3,595,354	2,127,824	1,467,824	307,036	1,160,493
" "	'10	3,366,009	1,916,044	1,449,965	287,532	1,162,433

DETROIT UNITED RAILWAY COMPANY.

June,	1911	$893,250	$563,512	$346,215	$177,178	$169,037
"	1910	831,472	512,996	330,912	168,530	162,381
6m., June,	'11	4,768,049	3,026,290	1,827,210	1,057,277	769,932
" "	'10	4,344,067	2,770,784	1,647,351	973,057	674,293

MASSACHUSETTS ELECTRIC COMPANIES.

Qtr., June	'11	$2,293,622	$1,410,089	$883,533	$462,234	$421,298
" "	'10	2,130,957	1,340,168	790,788	418,237	372,551
12m., June	'11	8,881,520	5,557,303	3,324,217	1,838,330	1,485,886
" "	'10	8,447,062	5,216,568	3,230,494	1,765,799	1,464,695

MONTREAL STREET RAILWAY COMPANY.

June,	1911	$430,026	$227,217	$204,809	$63,996	$140,813
"	1910	384,564	198,349	185,715	54,940	130,776

NASHVILLE RAILWAY & LIGHT COMPANY.

June,	1911	$157,570	$94,056	$63,514	$48,989	$14,525
"	1910	157,426	91,576	65,851	48,769	17,082
6m., June,	'11	952,118	564,045	388,073	292,191	95,882
"	'10	887,953	516,589	371,365	291,195	80,170

NORTHERN OHIO TRACTION & LIGHT COMPANY.

June,	1911	$245,097	$134,983	$110,114	$44,333	$65,781
"	1910	221,673	123,125	98,548	43,375	55,173
6m., June,	'11	1,222,676	697,023	525,653	267,107	259,545
" "	'10	1,087,335	624,250	463,105	259,916	203,188

PHILADELPHIA COMPANY.

June,	1911	$1,557,660	$1,020,065	$736,667	$590,633	$146,034
"	1910	1,681,626	944,400	920,411	576,592	343,819

General News

Construction News.

REFORM, ALA.—The Reform Ice & Light Company, it is reported, is contemplating the installation of an electric-light plant in Reform. John Newell is manager.

CLARKSVILLE, ARK.—Plans have been prepared for the installation ot electric and water plants and sewer system in Clarksville. The improvements will be extended to all parts of the city. R. L. Goodman, representing a Texas engineering company, has prepared the plans.

HIGDEN, ARK.—Negotiations are under way for financing the project which includes the construction of a concrete dam and hydroelectric plant on the Little Red River, near Higden, 55 miles north of Little Rock. Land for the proposed plant has been purchased. If negotiations are carried through, work will begin at once on the plant. The cost of the work is estimated at about $650,000. Dickinson & Watkins, State Bank Building, Little Rock, Ark., are engineers.

BUTTE CITY, CAL.—The Northern California Power Company, which is erecting a high-tension transmission line from Hamilton City to Princeton, recently established a substation in Butte City and has taken over the local electric plant owned by H. A. Dyer. It is reported that the Northern California Power Company is planning to extend its transmission line south to Maxwell, Williams and other points. The company has also taken over the plant at Williams.

MODESTO, CAL.—The plant and holdings of the La Grange Light & Power Company in Modesto have been purchased by the Sierra & San Francisco Power Company. The consideration is said to be $50,000. It is understood that no other branch of the Whitney Power Company, the holding company of the La Grange company, has been taken over. The La Grange Power Company held the contract for municipal lighting.

RIVERSIDE, CAL.—The Board of Supervisors of Riverside County has awarded the franchise for the erection of a transmission line in Riverside County, for which application was made by F. A. Worthley, to Fred Mechlin. The price paid for the franchise was $150.

SAN FRANCISCO, CAL.—Arrangements are being made by the Great Western Power Company to lay a cable under the bay and supply electricity generated by hydraulic power in San Francisco. The company recently absorbed the City Electric Company, of San Francisco. The company is planning to secure contracts for both light and power service in competition with the Pacific Gas & Electric Company, for both gas and electric service.

SANGER, CAL.—The San Joaquin Light & Power Company is contemplating extending its transmission lines from Sanger to Centerville, for which right-of-way is being secured.

BUENA VISTA, COL.—The old electric-light plant at Buena Vista is reported to have been destroyed by fire recently.

DENVER, COL.—The Colorado Telephone Company and the Tri-State Telephone & Telegraph Company have been consolidated. The new company, which will be known as the Mountain States Telephone & Telegraph Company, is capitalized at $50,000,000 and will operate exchanges and toll lines in Utah, Wyoming, Montana, Idaho, Eastern Arizona, New Mexico and Colorado. The officers of the new company are: E. B. Field, president; Edwin B. Field, Jr., vice-president and treasurer; J. E. MacDonald, secretary, and E. M. Burgess, general manager.

FORT COLLINS, COL.—The city of Fort Collins with a view ot erecting a hydroelectric plant on the Poudre River will file on a power plant site 33 miles west of Fort Collins. The proposed plant will be located at the head of the "Big Narrows," on the Poudre River. A proposition to issue bonds to the amount of $150,000 will be submitted to a vote of the people. It is proposed to install a plant with sufficient output to supply electricity to Fort Collins and other cities in Larimer County.

JOHNSTOWN, COL.—The Northern Colorado Power Company is reported to be contemplating extending its transmission lines from Milliken to Johnstown, a distance of 3 miles, to supply electricity in that town.

WILMINGTON, DEL.—Plans have been prepared for the construction of an electric railway along the Delaware River from South Wilmington to connect the system of the Wilmington & Philadelphia Traction Company with the New Castle & Delaware City Railway at New Castle. It is proposed later to extend the railway to Augustine Park, a summer resort located about 8 miles below Delaware City.

WASHINGTON, D. C.—Bids will be received by the Department of the Interior, Washington, D. C., until Aug. 8 for the installation of an electric elevator and the construction of the necessary shaft and penthouse at the Freedman's Hospital Buildings, Washington, D. C., in accordance with specifications and drawings, copies of which may be obtained upon application to the chief clerk of the department. Carmi A. Thompson is assistant secretary.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 15 for furnishing supplies at the various navy yards and naval stations as follows: Newport, R. I.—Schedule 3802, furnishing and installing switchboard, panels, etc.; schedule 3810, switch for I-beam trolley. Brooklyn, N. Y.—Schedule 3800, forced-draft blowers; schedule 3815, 55,000 ft. interior communication cable; 50,000 ft. night-signal cable; 19,000 ft. interior communication cable; 80,000 ft. steel wire, copper-clad cable; 50,000 ft. plain double conductor; 50,000 ft. double silk conductor; 30,000 ft. telephone cord; 75,000 ft. bell wire; 1000 ft. double-conductor diving wire; 64,000 ft. single-conductor wire; 40,000 ft. single-conductor wire; 270,000 ft. twin-conductor wire. Portsmouth, N. H.—Schedule 3816, one dynamo. Brooklyn, N. Y.—Schedule 3816, annual supply of combination desk and bracket fans. Boston, Mass., and Norfolk, Va.—Schedule 3816, night-signal keyboards. Newport, R. I.—Schedule 3779, furnishing and installing fire-alarm system; schedule 3816, furnishing speed lights, etc., at the Eastern navy yards and naval stations. Applications for proposals should designate the schedules desired by number.

LAKE CITY, FLA.—Plans are being made by Mrs. M. M. Jackson, owner of the White Springs resort, to install an electric plant to supply electricity for lamps for the Spring House and to light the entire town. It is proposed to utilize the overflow from the spring to operate the plant.

AUSTELL, GA.—The City Council is reported to be contemplating calling an election to submit the proposition to establish a municipal electric-light system in Austell to a vote of the people.

HAZELHURST, GA.—The city has voted an additional bond issue to the amount of $5,000 for the installation of an electric-light system. The city recently voted to issue $30,000 in bonds for a municipal electric plant.

JACKSON, GA.—The City Council has decided to call an election to vote on the proposition to issue $11,000 in bonds, the proceeds to be used for improvements to the electric-lighting system and water-works. Of this amount $6,000 will be used to secure electrical energy and $5,000 for extensions. The city will enter into a contract with the Central Georgia Power Company for 600 hp. It is proposed to establish a twenty-four hour service and supply electricity for manufacturing purposes as well as for lighting.

BONNERS FERRY, IDAHO.—The Bonners Water & Light Company has filed a petition with the County Commissioners for permission to attach its transmission line to the bridge across the Kootenai River, in return for which the company offers to furnish and maintain five arc lamps on the bridge.

ARENZVILLE, ILL.—An organization of a stock company to supply electricity and water for the village of Arenzville is reported to be under consideration. Electrical energy for operating the system may be secured from the Beardstown Electric Light & Power Company, of Beardstown, Ill.

BEECHER, ILL.—Plans are being considered for the organization of a stock company to install an electric plant in Beecher.

CHICAGO, ILL.—The receivers of the Illinois Tunnel Company have been authorized to issue $1,000,000 in notes, payable in one year, the proceeds to be used for extensions to the automatic telephone system.

PANA, ILL.—Bids will be received by Harry Stanton, city clerk, until Aug. 17 for water-works improvements as follows: Contract No. 1, reservoir, dam and pump tower; 2, water pipe and transmission line; 3, pumping machinery; 4, mechanical filtration plant; 5, gas-power electric plant; 6, power house; 7, steam boilers, engine and generator. Specifications may be obtained upon application to the city clerk or to Arthur Giesler, consulting engineer, Dayton, Ohio.

PINCKNEYVILLE, ILL.—The City Council has decided to purchase the local electric-light plant, if it can be bought at a reasonable price, or install a new plant.

TAMPICO, ILL.—The Dixon, Rock Falls & Southwestern Railway Company has selected a site on the Jacobs farm, about 2 miles south of Tampico, on which it will erect the power plant for the railway. About 3 miles of the road will be equipped for electrical operation.

MOUNT VERNON, IND.—The new franchise granted the Cumberland Telephone Company in Mount Vernon provides for the installation of an underground conduit system for its wires, and also provides that the company shall connect with the county lines.

SUMMITVILLE, IND.—Owing to the refusal of the Town Board to make further payment on the municipal electric-light plant a new company has been formed, consisting of the contractors who installed the system, to take over the plant, and is now supplying electrical service in Summitville. The plant has been remodeled and a twenty-four hour service given the city. The flat-rate system has been abolished and meters installed for all consumers. The street-lighting system has not been completed and many more lamps will be installed. Electricity for operat-

ing the system is obtained from the Indiana Union Traction Company. The rates have been slightly increased, but the service is much better.

BELLE PLAINE, IA.—The City Council has appropriated $10,000 for the new municipal electric-light plant now under construction. C. E. Atkinson, of Webster City, has charge of the erection of the building.

CENTRAL CITY, IA.—Work has commenced on the construction of the concrete dam in connection with the proposed municipal electric-light and power plant in Central City. It is understood that contracts have been placed for machinery and equipment for the power house.

KEOKUK, IA.—The St. Louis-Rock Island Railway Company is planning to build a power house at Hamilton.

MANCHESTER, IA.—The City Council has granted the petition of the business men to erect electroliers in the business district of the city. The business men agreed to pay for the installation of the new system provided the city would maintain them after they were erected.

POCAHONTAS, IA.—It is reported that the proposition to issue $11,000 in bonds, the proceeds to be used for the construction of a municipal electric-light plant, will be submitted to a vote on Aug. 15.

ROLAND, IA.—Bids will be received by J. A. Christian, city clerk, until Aug. 15 for the installation of an electric-light plant and water-works system. The Ames Engineering Company, of Ames, Ia., has charge of the engineering work.

SIOUX CITY, IA.—The Sioux City Service Company is reported to be considering the extension of its street railway system to Crystal Lake.

WEBSTER CITY, IA.—The City Council has appropriated $10,000 for the municipal electric-light plant, now in course of construction.

ABILENE, KAN.—Negotiations are under way between the Riverside Light & Power Company, of Abilene, and the city of Solomon, 8 miles distant, whereby the company is to supply electricity in that city. Bonds were recently voted by the city of Solomon for the installation of an electric-light system and water works.

ENGLEWOOD, KAN.—Plans are being prepared by the J. S. Worley Compay, consulting engineer, Reliance Building, Kansas City, Mo., for the installation of water and light systems in Englewood, for which bonds to the amount of $20,000 have been sold.

HILL CITY, KAN.—The J. S. Worley Company, consulting engineer, Reliance Building, Kansas City, Mo., has been engaged to prepare plans and supervise the construction of the proposed municipal water and light plant, the cost of which is estimated at $50,000.

HORTON, KAN.—Proposals will be received at the office of the city clerk, Horton, Kan., until Aug. 8, for furnishing one 100-hp high-speed engine, plans and specifications for which are on file at the above office. G. E. Johnson, of Sabetha, Kan., is engineer, and B. B. Norris is city clerk

LA CYGNE, KAN.—The J. S. Worley Company, consulting engineer, Reliance Building, Kansas City, Mo., is preparing plans for the construction of the proposed municipal electric-light and water plant, to cost about $30,000. Bids will be received for construction of the plant about Aug. 15.

NICKERSON, KAN.—Plans are being considered for the installation of an electric-light system and water works in Nickerson. Two propositions are under consideration. The first is to have the United Water, Gas & Electric Company, of Hutchinson, Kan., extend its transmission lines to Nickerson and deliver energy at the substation. The other for the town to erect the line to Hutchinson. The city will own the local system and install its own water works, the pumping plant being operated by electricity.

TOPEKA, KAN.—The City Commission has rejected all bids submitted for the installation of an ornamental lighting system on Kansas Avenue from First to Tenth Street. Bids for installing the lighting system have been readvertised.

WATERVILLE, KAN.—Plans are being prepared by the J. S. Worley Company, consulting engineer, Reliance Building, Kansas City, Mo., for the construction of the proposed municipal water and light plant, to cost about $30,000.

LEXINGTON, KY.—Plans are being prepared by Sargent & Lundy, of Chicago, Ill., consulting engineers, for the power house of the Kentucky Traction & Terminal Company, which recently took over the traction properties in and around Lexington. Contracts, it is said, will be awarded for the erection of the building and installation of machinery in the near future.

LOUISVILLE, KY.—The Louisville & Interurban Railway Company has filed amendments to its charter increasing its capital stock from $2,200,500 to $3,750,000. The increase in capitalization is due to the purchase of the Louisville & Eastern Interurban Railway some time ago.

ALGIERS, LA.—The Algiers Railway, Light & Power Company has been notified by the City Council that it must extend its street railway system to McLeanville and the Mississippi River, in accordance with its franchise.

BOYCE, LA.—It is reported that the town of Boyce has awarded a contract for the construction of a municipal electric-light plant.

SHREVEPORT, LA.—Anderson Offutt, consulting engineer, of New Orleans, La., engaged by the city of Shreveport to prepare an estimate of the cost of installing a municipal electric-light plant, has submitted his report to the City Council, in which he states that a plant could be built for $310,000 and operated at a cost of $270 per day. He also states that electricity could be supplied to private consumers at a cheaper rate than at present. An election may be called to submit a proposition to issue bonds for construction of a plant to the voters.

BALTIMORE, MD.—Sealed proposals will be received by the Board of Awards at the office of the City Register, City Hall, Baltimore, Md., until Aug. 9 for one 35-kw generator and engine, one 15-kw generator and engine, one switchboard and connections, valves, piping, etc., to be installed in the sewage pumping station, plans and specifications for which are on file at the office of Calvin W. Hendrick, chief engineer of the Sewerage Commission, and can be obtained at the office of the Sewerage Commission, Room 904, American Building, Baltimore, Md. A deposit of $5 will be required for each set of plans, which will be refunded upon return of same.

EMMITSBURG, MD.—Plans are being considered by the town of Emmitsburg to secure electrical service from the power plant of the Frederick Railroad Company and the Hagerstown Railway Company, which will be located at Security.

AUBURN, MASS.—The Selectmen have granted the Worcester Suburban Electric Company a franchise to supply electricity for a period of twenty years in Auburn. Under the terms of the franchise the company is to supply 32-cp incandescent street lamps at the rate of $14 per lamp per year with midnight service; the rates for electricity for commercial lighting are as follows: Primary rate 16 cents per kw-hour and secondary 12 cents per kw-hour. The transmission line of the Worcester Suburban Electric Company will be extended from Millbury, a distance of 1½ miles.

FRANKLIN, MASS.—The plant and holdings of the Union Electric Light Company, of Franklin, Mass., owned by the Stone & Webster Corporation, of Boston, Mass., have been sold to C. D. Parker & Company, who, it is said, are interested in the Massachusetts Lighting Companies. The property of the Foxoboro Electric Company has also been purchased by C. D. Parker & Company and will be operated in connection with the Union Electric Company, with the main office in Franklin.

GLOUCESTER, MASS.—The Gloucester Electric Light Company has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $75,000 in capital stock, the proceeds to be used to place its wires underground in the principal streets of the city and for the erection of an electric-light system in the town of Essex, which includes about 12 miles of public street lighting and 6 miles of streets on the commercial lighting service. The cost of the installation of the entire underground system in Gloucester is estimated at $49,340. Improvements are to be made at the power plant, including the installation of a new coal-conveying apparatus, two 254-hp boilers, with stokers for same, and the erection of addition to boiler-room, which will involve an expenditure of about $26,595. The cost of erecting the system in Essex, including street lighting and commercial service, is estimated at $14,669.

LEICESTER, MASS.—Plans are being considered for the installation of a central heating and lighting plant for the town buildings to be erected on Colburn Court.

LOWELL, MASS.—The lands and building committee is considering the question of installing an electric-light plant in the basement of the City Hall to supply electricity for lamps and motors for the City Hall and Memorial Building.

MILLBURY, MASS.—Plans are being prepared by the Worcester Suburban Electric Company for the erection of a substation in Millbury. A. M. Hall is superintendent of the Millbury district.

NORTH EASTON, MASS.—The Brockton Electric Light Company has presented a petition to the Selectmen of North Easton for a franchise to erect an electric-light system in this village.

SOUTH HADLEY FALLS, MASS.—The South Hadley Falls Electric Light Company is contemplating extending its transmission lines from South Hadley Center by the way of Five Corners to Granby, to supply electrical service in that town.

STERLING, MASS.—At a town meeting held July 19 it was voted to extend the electric-light system to Pratts Junction, a distance of 2 miles, for which $2,000 was appropriated. The proposition to extend the system to Sterling Junction will be voted on later.

WORCESTER, MASS.—The Worcester Suburban Electric Company has petitioned the State Board of Gas and Electric Light Commissioners for authority to issue $125,000 in capital stock, the proceeds to be used to pay floating indebtedness and to make extensions and improvements to its plant.

GRAND RAPIDS, MICH.—The business men's organizations from every section of the city have joined in asking the Council to appropriate $10,000 for the installation of a new street-lighting system on Monroe and Canal Streets to replace the present arches.

HERSEY, MICH.—A new power house is being erected by Frank McIntyre. It is understood that the output of the electric plant will be increased to 300 hp.

BROWN VALLEY, MINN.—At an election held July 25 the proposition to issue $10,000 in bonds, the proceeds to be used for the construction of an electric-light plant in Brown Valley, was carried. L. C. Bigelow is recorder.

MINNEOTA, MINN.—The village has granted a franchise to J. H. Jonathan to construct and operate an electric-light plant in Minneota.

ROCHESTER, MINN.—The contract for the installation of the ornamental street lighting system on Broadway has been awarded to W. O. Hartig, of Minneapolis, Minn., for $8,661. Cluster lamps will be erected.

ST. PAUL, MINN.—The joint city hall and court house commission has awarded the contract for supplying light, heat and power for the city and county buildings for the coming year to the St. Paul Gas Light Company for $13,000, the same as last year. Only one bid was received.

TOWER, MINN.—Bids were opened by the City Council July 18 for the construction of a hydroelectric plant at Pike River Falls, to replace the present steam plant owned by the city. The lowest bid submitted was about $23,000. Bonds to the amount of $16,000 were recently voted for the purpose of building the plant. It is expected that the city will readvertise for bids.

TWO HARBORS, MINN.—Extensive improvements are being made to the municipal electric-light and water plant, including the installation of a 10½-in. Westinghouse cross-compound air compressor to operate the Ingersoll-Rand rock drill at the quarry, located a short distance from the electric and water plant. W. R. Coleman is chief engineer.

KANSAS CITY, MO.—The Metropolitan Street Railway Company is planning to remove a 1000-kw generator from its Fifteenth Street station to its station on Fortieth Street. A 3000-kw generator will be installed in the Fifteenth Street station.

KANSAS CITY, MO.—The Commissioners of Kansas City have decided to locate the buildings for the new municipal electric-light plant in front of the municipal water plant at Quindaro. The same boilers will supply steam for operating the generating plant and pumping station.

KIRKWOOD, MO.—A special election will be held Aug. 19 to vote on the proposition to issue $10,000 in bonds, the proceeds to be used for extensions to the municipal electric-light plant.

ST. LOUIS, MO.—The new electric plant of the Laclede Gas Light Company, located at Mound and Mullanphy Streets, St. Louis, Mo., will be completed about Aug. 15. The plant has an output of 8000 kw and cost about $475,000. The original schedule of prices for electrical service of the Laclede Gas Company ranges from 4 cents to 12 cents per kw-hour for lamps and from 3 cents to 10 cents for motors. It is said that a permanent and lower-price schedule is to be prepared and will be made public about the middle of September.

GORDON, NEB.—Sealed proposals will be received by H. D. Huntington, village clerk, until Aug. 10 for the installation of electric-light and sewer systems and extensions to water mains. Copies of plans and specifications can be obtained upon application to the village clerk.

LINCOLN, NEB.—Arrangements have been made by the Lincoln Gas & Electric Company for the rehabilitation of its system. The approval of the Nebraska Public Service Commission has been secured.

OMAHA, NEB.—The Omaha Electric Light & Power Company has secured the contract for furnishing electricity for lamps and motors for the new Union Pacific Railroad Building in Omaha. It will require 500 hp to operate motors, elevators, pumping machinery, heating system and ventilators. About 6000 lamps will be installed.

VALENTINE, NEB.—Plans are being prepared by the J. S. Worley Company, consulting engineer, Reliance Building, Kansas City, Mo., for the reconstruction of the hydroelectric plant in Valentine.

WYMORE, NEB.—Plans have been adopted by the City Council for lighting the streets of the town. The plans call for the installation of twenty-four ornamental lamp standards in the business district and 250 incandescent lamps in the residence portion of the town. The municipal electric plant is nearly completed and will soon be turned over to the city. An electrically driven pump is also to be installed. Bids will be received until Aug. 9 by F. V. Meek, city clerk, for construction of distributing and street-lighting system, including the erection of about 10 miles of wire. The cost of the work is estimated at about $9,000. C. H. Meeker is in charge of construction of both the electric-light plant and water-works system.

KEYPORT, N. J.—Arrangements are being made by the Middlesex & Monmouth Light, Heat & Power Company for the installation of the new street-light system which the Borough Council contracted for some time ago. Tungsten lamps will be installed.

MARION, N. J.—The Public Service Corporation of New Jersey has awarded the general contract for the construction of a power house at Marion to E. M. Waldron & Company, of Newark, N. J. The building will be 100 ft. x 100 ft. and will cost about $40,000.

RED BANK, N. J.—Further steps have been taken by the Commissioners of Red Bank toward equipping the water-works plant as a municipal electric-light and power station. Thomas F. Hylan, of the Blackall & Baldwin Company, contracting engineer, of New York, N. Y., has been engaged to prepare plans and estimates of cost of establishing the proposed plant.

ALBANY, N. Y.—The Albany Electric Illuminating Company has filed plans for the 100 new so-called double Fifth Avenue lamps which the company is to erect on certain streets under the terms of the new street-lighting contract with Commissioner Greenalch, of the Department of Public Works. Under the contract the company pays for both poles and lamps, each pole costing about $157. For all other street lamps in the city the municipality owns the poles and the city furnishes the lamps. The contract calls for new lamps throughout the city, which will mean the installation of about 1000 new lamps. Besides replacing the old arc lamps with new magnetite lamps, the arc lamps in the alleys will be replaced with incandescent lamps. The company is now installing underground conduits on several streets in the city.

BROOKLYN, N. Y.—The Public Service Commission, First District, has authorized the Nassau Electric Railway Company to issue $52,000 in bonds.

HARTWICK, N. Y.—The Hartwick Power Company has applied to the Public Service Commission, Second District, for permission to exercise a franchise to supply electricity in the town of Hartwick.

NEW YORK, N. Y.—The Public Service Commission, First District, has authorized the Manhattan Three-Cent Line to issue $50,000 in capital stock.

NEW YORK, N. Y.—Bids will be received by Arthur O'Keefe, Commissioner of Bridges, Department of Bridges, 13 to 21 Park Row, New York, N. Y., until Aug. 10, for furnishing and erecting one duplex, two-stage, motor-driven air compressor at the Williamsburg Bridge in the Borough of Brooklyn, N. Y. Blank forms and specifications may be obtained at the above office.

NEW YORK, N. Y.—Bonds to the amount of $17,200,000, it is stated, have been sold by the New York, New Haven & Hartford Railroad Company, for the New York, Westchester & Boston Railway Company, a subsidiary company. The New York, Westchester & Boston Railway Company is building a four-track electric railway from 138th Street, New York, to Port Chester, with a branch from Pelham via Mount Vernon and Scarsdale to White Plains and a branch to Clason's Point and Throg's Neck.

NEW YORK, N. Y.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Aug. 25 for the installation of a conduit and wiring system for lamps and motors and conduits for standard clock, telephone, bell, vault protection, fire alarm and telegraph systems in the new United States post office at New York, N. Y., in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of McKim, Mead & White, 160 Fifth Avenue, New York, N. Y. James Knox Taylor is Supervising Architect.

NEW YORK, N. Y.—Sealed bids will be received by Patrick A. Whitney, Commissioner of Correction, Department of Correction, 148 East Twentieth Street, New York, N. Y., until Aug. 10 for furnishing labor, superintendence, machinery, blocks, tackle and other appliances to lay, draw into ducts and properly connect up a complete electric-feeder system, including covers for manholes for the lighting and power service and a feeder and subsidiary systems for the street lighting, including furnishing and connecting up mechanically and electrically the street lamp-post lanterns, etc., on Hart's Island, New York. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—The Public Service Commission has authorized the Long Acre Electric Light & Power Company to issue $2,000,000 in capital stock and $5,000,000 in bonds, $4,000,000 of which may be issued upon the acquisition of property, except $600,000, which may be used for other expenses. No bonds are to be sold until $1,000,000 of the stock has been subscribed and fully paid for, when $2,000,000 may be put on the market at not less than 90 per cent of their par value. The remaining $2,000,000 in bonds to be sold at the same terms when another $1,000,000 of capital stock has been sold. The proceeds to be used for the acquisition of property, construction, completion and extensions and improvements to its plant or distributing system.

NEW YORK, N. Y.—The Public Service Commission, Second District, has granted the New York, Westchester & Boston Railway Company authority to execute a mortgage on all its property to secure an issue of bonds to the amount of $60,000,000. The company is authorized to issue at present bonds to the amount of $20,100,000, the proceeds to be used to refund at par the bonds of the New York, Westchester & Boston Railway Company to the amount of $16,200,000, to refund at par the principal of bonds secured by the first mortgage of the New York & Port Chester Railroad Company amounting to $100,000, and for the purpose of acquisition of real estate and construction of the branch road of the company from Mount Vernon to White Plains, as previously authorized by the commission, $3,800,000. Authority to issue $5,000,000 in bonds under the mortgage of October, 1904, is revoked.

ONEIDA, N. Y.—The date for receiving bids for lighting the streets and public places for periods of one, three and five years has been extended from July 25 to Sept. 15. Bids are to be submitted on ninety-two inclosed arc lamps of 350 watts, with all-night and every-night service. Albert Morris is chairman of Board of Public Works.

ONEIDA, N. Y.—The Oneida Railway Company has applied to the Public Service Commission for permission to exercise its franchises for construction of a street railway through Madison and Sconondoa Streets in Oneida. The cost of the work is estimated at about $25,000. The company is now operating over the tracks of the West Shore Railroad between Utica and Oneida, which are equipped for electrical operation.

POTSDAM, N. Y.—The placing of all electric wires in underground conduits in the business district of the city is under consideration.

WADDINGTON, N. Y.—It is reported that Pittsburgh capitalists interested in the Long Sault dam project and connected with the Pittsburgh Reduction Company have purchased the Waddington holdings of M. W. Ogden, of Washington, D. C. It is also stated that an offer of $12,000 for Point Iroquois, Ontario, has been refused.

CHARLOTTE, N. C.—The Erwin Cotton Company is reported to be planning to equip the Pearl Cotton Mills and Mill No. 1 for electrical operation.

HUNTERSVILLE, N. C.—The Bank of Huntersville is reported to be interested in a project to instali an electric-light plant with an output of about 35 kw, which will probably be driven by gas or steam power.

RALEIGH, N. C.—The directors of the State Hospital for the Insane have decided to install an electric-light plant for the institution. Electricity for operating the system will be secured from the Carolina Power & Light Company.

FARGO, N. D.—Plans are being prepared by City Engineer Anders for the proposed municipal electric-light plant and the new city pumping station to be located at the filter plant.

GLEN ULLIN, N. D.—The installation of an electric-light plant in Glen Ullin is reported to be under consideration. C. E. V. Draper, of Mandan, N. D., is engineer.

ASHTABULA, OHIO.—The question of making improvements to the municipal electric-light plant is under consideration. The proposition to issue $25,000 in bonds for that purpose will probably be submitted to the voters at the election in November.

CLEVELAND, OHIO.—Plans have been completed by the Cleveland, Painesville & Eastern Traction Company for consolidating the two power houses and locating the main generating station at Painesville. At present two plants are operated, one located at Willoughby and the other at Painesville. The former supplies energy for the electric railway extending from Cleveland to Painesville and the latter for operating the cars from Painesville to Ashtabula.

DAYTON, OHIO.—Plans are being made to organize a new light and power company to complete for local business with the Dayton Light & Power Company. The company will be capitalized at $1,000,000 and will apply to the City Council for a franchise in the near future. The Wise-Schieble Company, Fifth and Brown Streets, Dayton, Ohio, is interested in the project. It is understood that the plant of the Wise-Schieble Company will form the nucleus of the new concern.

DEFIANCE, OHIO.—The Auglaize Power Company, of Toledo, Ohio, has awarded the contract for the construction of its hydroelectric plant at Defiance to the Ambursen Hydraulic Construction Company, of Boston, Mass. The dam will be 500 ft. long and the power house 150 ft. in length. About 4000 hp will be developed.

SPRINGFIELD, OHIO.—The City Council is considering the question of establishing a municipal electric-light plant in Springfield.

GROVE, OKLA.—The City Council has sold bonds to the amount of $25,000 authorized for the installation of a combined electric and water plant to B. F. Stone, of Oklahoma City, who was also awarded the contract for construction of the systems. An injunction has been served on the Council restraining it temporarily from issuing the bonds. The suit was filed by taxpayers who allege irregularities.

BAY CITY, ORE.—Arrangements are being made by the Tillamook Public Service Corporation for the installation of an electric-light plant in Bay City. Contracts for equipment and machinery for the power house have been placed. The city has awarded the company the contract for street lighting, under which it is to supply twenty-five arc lamps. J. H. West is superintendent.

EUGENE, ORE.—At an election held July 18 the proposition to issue $57,000 in bonds, the proceeds to be used for improvements to the waterworks system and for establishing a street-lighting system, was carried. The city already owns an electric plant. and it is proposed to install a distributing system.

PORTLAND, ORE.—The plant of the Portland Railway, Light & Power Company being erected on the Clackamas River at River Mill, 1½ miles above Estacada, was badly damaged by fire on July 17, causing a loss of several thousand dollars. The boiler house, engine-room and tower on the west side of the river were destroyed.

PRAIRIE CITY, ORE.—It is reported that the plant and holdings of the Prairie City Light & Power Company have been purchased by R. C. Reece and associates, of Prairie City and Canyon City. The consideration for the plant, including the grist mill, is said to be $22,000.

BRISTOL, PA.—The Trenton, Bristol & Philadelphia Street Railway Company will purchase a 500-kw generating unit within the next thirty days.

LANCASTER, PA.—Application will soon be made to the State Department for a charter for eight companies to operate in Lancaster, Manor, Manheim, East and West Lampeter, East and West Hempfield and Warwick Townships.

LEBANON, PA.—The Board of Managers of the Mount Lebanon United Brethren Campmeeting Association has decided to light the grove this year with electricity. Mr. Laudermilch, a local electrician, has been authorized to install a temporary plant at the park, and, if satisfactory, a permanent system will probably be installed.

NANTICOKE, PA.—Arrangements are being made to increase the output of the electric generating station at the Lackawanna collieries in Nanticoke at a cost of about $30,000. Two additional generators with boilers will be installed. The Auchincloss, Truesdale, Bliss and Avondale, all with washeries attached, of the Lackawanna collieries, are equipped for electrical operation. It is expected that the Loomis colliery will be put in operation within a short time.

NEWMANSTOWN, PA.—The new electric plant just completed will supply electricity for lamps and motors in the towns of Newmanstown, Millbach, Richland, Sheridan, Schiefferstown and Denver, Lancaster County. The electric transmission line to carry current across the South Mountain to Denver has been completed.

NEW OXFORD, PA.—The installation of a municipal electric-light plant in New Oxford is under consideration.

NEW OXFORD, PA.—Application will be made to the Governor of Pennsylvania on Aug. 15 for a charter for the New Oxford Light, Heat & Power Company. Raymond F. Topper, George J. Benner and Stella I. Raffensberger are interested in the project.

PHILADELPHIA, PA.—Permits have been granted to the Philadelphia Rapid Transit Company for the construction of a power house on Delaware Avenue, south of Laurel Street, to cost $25,000; also for the erection of a substation on East Ledderly Street.

STOWE, PA.—The power plant of the Schoen Steel Wheel Company's yards in Stowe Township was destroyed by fire on July 22, causing a loss of about $15,000.

TRUMBAUERSVILLE, PA.—The village of Trumbauersville is reported to have decided to install an electric-light plant.

WEATHERLY, PA.—Plans are being considered to enlarge the municipal electric-light plant. In addition to lighting the town the plant will supply electricity for lamps and motors for the Lehigh Valley Railroad shops.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is reported to have awarded contract for the erection of superstructure of power house at the foot of Charlotte Street on Cooper River to J. W. Lindsay & Company, of Philadelphia, Pa. The building will be 120 ft. square, two stories high, of brick or cement; smokestack 200 ft. high. The equipment will include 2640 hp in boilers, one 1000-kw turbo-generator, two 2000-kw turbo-generators, three 500-kw rotary converters, 35-kw motor-generator exciter, with switchboard, exciter, etc., to cost approximately $200,000.

HONEA PATH, S. C.—Plans are being prepared for the installation of a municipal electric-light plant, to cost about $37,000. Bids for he construction of the plant will be called for about Sept. 1. Thomas W. Cothran, of Greenwood, S. C., is engineer in charge.

GETTYSBURG, S. D.—Sealed bids will be received by the Board of County Commissioners of Potsdam Countyy, Gettysburg, S. D., until Aug. 9 for combination gas and electric lighting fixtures for the county court house. Specifications can be obtained on application to L. J. Klein, county auditor, Gettysburg, S. D.

CHATTANOOGA, TENN.—Orders have been placed by the Chattanooga Railway & Light Company with the General Electric Company, of Schenectady, N. Y., for one 1000-kw motor-generator set, four 1500-kw transformers and a switchboard.

MEMPHIS, TENN.—Plans are being prepared for the installation of an electric plant to supply electricity to light the new union station, yards, terminal and subway, which will form part of the yards, to cost about $40,000.

PULASKI, TENN.—The town of Pulaski has received authority from the State Legislature to issue $20,000 in bonds, the proceeds to be used for reconstruction of the municipal electric-light plant, plans for which are being prepared by C. L. Wheeler, electrical superintendent.

ROCKWOOD, TENN.—It is reported that the owners of the Rockwood Mills are thinking of enlarging their plant and installing a new power plant. The question of equipping the mill for electrical operation is under consideration. If it is decided to use electricity the company will generate its own energy.

ROGERSVILLE, TENN.—Application has been made to the Town Council for a franchise to supply electricity for lamps and motors in Rogersville and vicinity. McDonald Brothers and other capitalists are interested in the project. It is proposed to develop water-power in the Holston River, about 3 miles above Rogersville. The initial installation will provide for 250 hp, and as the demand increases the plant will be enlarged. The construction of an electric railway, connecting Rogersville and Hale Springs, is also under consideration.

SOUTH PITTSBURGH, TENN.—The South Pittsburgh Light & Power Company will erect a temporary building to replace the power house recently burned, which later will be replaced by a permanent structure. It is reported that the company is asking for bids on a 50-kw, 2200-volt, 60-cycle generator, with exciter, switchboard, etc. Charles Houston is manager.

ANGLETON, TEX.—The Angleton Gin & Power Company, it is reported, is planning to instali an electric-light plant.

BEAUMONT, TEX.—The Stone & Webster Engineering Corporation, of Boston, Mass., has secured an option on the property and holdings of the Beaumont Ice, Light & Refrigerating Company, except its ice and refrigerating plant. The property involved in the pending transaction includes the local electric-light and power plant. The option runs until Oct. 3. It is stated that these will form a nucleus for an extensive railway system in this city and an interurban railway to extend from Beaumont to Port Arthur, a distance of 25 miles.

BONHAM, TEX.—The Bonham Gas & Electric Company is asking

for bids for the construction of a power house to be erected on East Second Street, Bonham.

BRYAN, TEX.—At an election to be held Aug. 21 the proposition to issue $20,000 in bonds, the proceeds to be used for extensions and completion of electric-light, sewerage and water-works systems, will be submitted to a vote.

COLEMAN, TEX.—Preparations are being made for the construction of a new power house for the municipal electric-light plant.

MEXIA, TEX.—The Mexia Light, Water & Sewerage Company is making arrangements to establish a day service for lamps and fans. It is understood that orders have been placed for additional equipment for plant.

PADUCAH, TEX.—The City Council is reported to have granted a franchise to a company to construct and operate an electric-light system in Paducah.

STOCKDALE, TEX.—The Farmers' Gin Company, of Stockdale, Tex., is installing an electric-light plant.

BRIGHAM CITY, UTAH.—The Box Elder Power & Light Company, formerly known as the Brigham City Electric Light Company, which operated in this city before the municipal electric plant was put in operation, is offering bonds to the amount of $75,000. The company owns a pipe line and a valuable power house site at Box Elder, where it is estimated that from 700 hp to 800 hp can be developed. John C. Knudson is treasurer of the company.

BOWLING GREEN, VA.—The installation of an electric-light plant in Bowling Green is under consideration, for which bids for franchise are being called for.

FARMVILLE, VA.—The plant and holdings of the Farmville Water, Light, Heat & Power Company have been taken over by the municipality.

LEESBURG, VA.—The Leesburg Telephone Company has increased its capital stock from $10,000 to $25,000, the proceeds to be used for extensions and improvements to its system. M. E. Church is general manager.

BREMERTON, WASH.—Bids will be received at the office of the United States Marine Corps, Mills Building, Washington, D. C., until Aug. 7 for furnishing electric-lighting fixtures for the marine barracks, Navy Yard, Puget Sound, Wash. For further information address the quartermaster, United States Marine Corps, Washington, D. C.

ELLENSBURG, WASH.—The City Council is reported to be considering the question of issuing $100,000 in bonds, the proceeds to be used for improvements and extensions to the municipal water-works system. The proposed work includes extensions to main pipe line, reservoir, two 2,000,000-gal. pumps to be operated by electricity, supplied by the municipal electric plant.

FT. FLAGLER, WASH.—The contract for installing an electric-light system at Ft. Flagler, Wash., has been awarded to the W. E. Chase Engineering Company, of Spokane, Wash., for $29,900.

MEYERS FALLS, WASH.—Surveys are being made by the Stevens County Power & Light Company with a view of extending its transmission line to Marcus, Wash.

PORT ANGELES, WASH.—The Olympia Power Company is reported to have awarded contract for the construction of right-of-way for its proposed transmission line from Port Angeles to Irondale to P. J. Woods. The contract calls for clearing the right-of-way and cedar poles, at a cost of $18,000. The company will erect the transmission line.

PORT ORCHARD, WASH.—The contract for construction of power house at Washington Veterans' Home, bids for which were opened July 24, has been awarded by the State Board of Control to Pauer & Peters, of Seattle, Wash., for $4,620.

RANDALL, WASH.—Preparations are being made by the Valley Improvement Company, of Portland, Ore., to begin active construction work on its proposed power plant to be erected near Randall. It is reported that the proposed development will cost about $15,000,000 and electrical energy generated at the plant will be transmitted to Portland, Ore.

SUMNER, WASH.—Application has been made to the Council by the Puget Sound Company for a franchise to supply electricity in Sumner.

WALLA WALLA, WASH.—The city clerk has been authorized to advertise for bids for supplying electricity for arc and cluster lamps in Walla Walla for both five and ten-year periods.

CHARLESTON, W. VA.—The Appalachian Power Company, recently incorporated under the laws of the State of Virginia, has applied to the Secretary of State for authority to do business in West Virginia. The company is capitalized at $25,000,000 and has taken over the property of the Bluestone Traction Company, of Bluefield, W. Va., and is developing a water-power on New River. It proposes to supply electricity in the Pocahontas coal fields.

DUNBAR, W. VA.—The power plant of the Charleston-Dunbar Traction Company, which proposes to build an electric railway from Charleston to Dunbar, will be located in this town.

KENOVA, W. VA.—The Consolidated Light & Railway Company, it is reported, will make application for a franchise to operate an electric-light system in Kenova. William C. Sproul is president of the company.

RICHWOOD, W. VA.—The Cherry River Boom & Lumber Company has awarded the contract for the construction of an electric-light plant and boiler plant to Shinn Brothers.

ANTIGO, WIS.—The Antigo Electric Company has taken over the property of the Antigo Gas Company. The two plants will be operated by the Antigo Electric Company.

BARABOO, WIS.—The installation of a municipal electric-light plant has been recommended by the special lighting committee to the Council.

LIVINGSTON, WIS.—The Council has granted the Mineral Point Power & Electric Light Company a franchise to erect transmission lines in Livingston to supply electricity for lamps and motors in this village.

MILWAUKEE, WIS.—An appropriation of $40,000 has been recommended by Joseph A. Mesiroff, city engineer, to install an electric plant at the refuse incinerator to utilize the waste steam in operating the Milwaukee River and Kinnickinnic River flushing tunnel pumping engines. If electric pumps are not installed in the Milwaukee River station, the present plant will practically have to be replaced. The station has been in operation for twenty-three years.

OSHKOSH, WIS.—Plans are being prepared by the Northern Hydro-Electric Company, of Green Bay, Wis., for the erection of a transmission line from its power plant at High Falls, Wis., to Oshkosh. At present the company is developing 9000 hp at its plant on the Peshtigo River; it is estimated that 14,500 hp can be developed.

STETTLER, ALTA., CAN.—Contracts have been awarded for construction of the municipal electric-light plant in Stettler as follows: For generator to the Swedish General Electric Company at $2,625; for engine to the Robb Engineering Company at $2,425; for boiler to the Watrous Engine Works at $1,601; poles to the Western Lumber Company, for 35-ft. poles, $4.40 each, and for 30-ft. poles, $2.40 each; pole-line materials and copper wire, transformers and meters to the Canadian General Electric Company, and for street-lighting materials to the Canadian Westinghouse Company for $360.

KAMLOOPS, B. C., CAN.—A preliminary report prepared by H. K. Dutcher, engineer, recommending the development of Paul Creek for both water and electrical supply is reported to have been submitted to the Council. It is estimated that 1200 hp can be developed at a cost of $150,000, which includes a gravity water supply system costing $60,000.

VANCOUVER, B. C., CAN.—It is expected that the transmission lines of the Western Canada Power Company will reach Vancouver in the near future; the company expects to be ready to deliver electrical energy in this city by Sept. 1. The transmission line will extend from its power plant on the Stave River to Vancouver, a distance of 45 miles. An agreement has been made between the Western Canada Power Company and the Great Northern Railway Company, whereby the power company will use the right-of-way of the railway company from Burnaby to Vancouver to enter the city. Energy will be delivered to the Burnaby substation, which is nearly completed, where it will be stepped down from 60,000 volts to 13,000 volts for transmission to Vancouver.

WARDNER, B. C., CAN.—Announcement has been made by the Bull River Electric Power Company that it has secured funds to complete the installation of machinery at the falls and to erect necessary transmission lines. George E. Henderson, of Wardner, B. C., is president and manager.

PORTAGE LA PRAIRIE, MAN., CAN.—The Town Council has adopted a resolution to make the Central Electric & Gas Company an offer of $110,000 for its plant, subject to ratification by the ratepayers. It is expected that the offer will be confirmed by the ratepayers.

SELKIRK, MAN., CAN.—It is reported that W. E. Skinner, consulting engineer, has been engaged by the town of Selkirk in connection with either the installation of a municipal plant or making arrangements with the city of Winnipeg or the Winnepeg Electric Railway Company for electrical energy.

FREDERICTON, N. B., CAN.—It is reported that surveys have been completed by the Eel River Power Company of the lakes in the vicinity of Canterbury and also sites for two dams near Benton. The company proposes to build a hydroelectric plant to supply electricity in Fredericton, St. Stephen, Woodstock and other towns in this vicinity. The establishment of a street-car service is also under consideration. John G. Murchie, George A. Murchie, of Calais, Maine; H. A. Connell and George McPhail, of Woodstock, are interested in the project.

MILLTOWN, N. B., CAN.—Application has been made to the town of Milltown for a franchise to establish an electric power and heating plant in this town.

BLYTH, ONT., CAN.—At an election held recently the by-law authorizing the purchase of the local electric light plant by the municipality was carried.

GODERICH, ONT., CAN.—The by-law to ratify an agreement with John L. Brodie to supply electrical energy to the amount of 325 hp to the town at a cost of $34 per horse-power per year will be submitted to the ratepayers on Aug. 5.

HAMILTON, ONT., CAN.—The by-law to appropriate $505,000 to install a municipal electric plant to distribute electrical energy supplied by the Hydro-Electric Power Commission was carried at an election held July 25. It is understood that tenders will be called for in stallation of the system as soon as plans are prepared.

LINDSAY, ONT., CAN.—It is reported that the question of purchasing the local electric-light plant to be owned and operated by the munici-

pality or of granting the Electric Power Company a franchise is under consideration. Before submitting the proposition to the ratepayers careful investigation will be made of the possible development and cost of Fenelon Falls.

SARNIA, ONT., CAN.—It is reported that negotiations are under way for the purchase of the property of the Sarnia Gas & Electric Company by the municipality. It is said that plans will be prepared by the town engineer for the installation of a municipal lighting system.

TORONTO, ONT., CAN.—The Toronto General Hospital Board has decided to install a 400-kw electric plant to supply electricity for lamps and motors to the new hospital buildings being erected on College Street. J. W. Flavelle, of Toronto, is chairman of board.

WALKERTON, ONT., CAN.—Plans are being considered by the Walkerton Electric Light & Power Company for the construction of a dam across the Saugeen River and developing the waterfalls there to generate electricity for transmission to Walkerton.

WILKIE, SASK., CAN.—Bids will be received by T. A. Dinsley, secretary and treasurer, until Aug. 21 for furnishing and installing the following equipment and machinery: Tender A, Electrical machinery—One 60-kw, three-phase, 60-cycle, 2300-volt alternating-current generator, one exciter for above, one marble switchboard, instruments and switches, three 2200-volt motors, back geared to pumps, five transformers for lighting system, series tungsten lamps for street-lighting system, approximately 25 cwt. of weatherproof copper wire (line material, guy wire, arms, pins, insulators, etc.), cedar poles. Tender B—One 100-hp international combination engine. Tender C—Pumping machinery—One working head and deep-well cylinder, one 500-000-gal. pump, one air compressor and necessary shaftings and belting. Tender D—One pneumatic storage tank. Tender E—Cast-iron water pipe. Tender F—Laying cast-iron water pipe. Tender G—Erection of power house and construction of reservoir. Plans and specifications may be seen at the above office or may be obtained upon application to McArthur & Murphy, Bottomly Block, Saskatoon, Sask., Can., engineers.

New Industrial Companies.

THE EFFICIENCY ELECTRIC COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $100,000 to manufacture electrical batteries and supplies. The incorporators are: R. C. Carpenter, C. G. Johnson and V. J. Johnson.

C. G. EVERSON & COMPANY, of Chicago, Ill., have filed articles of incorporation with a capital stock of $40,000 for the purpose of manufacturing gas and electric fixtures. The incorporators are: R. B. Everson, H. V. Willman and C. G. Everson.

THE GRIFFITHS ELECTRIC CONTRACTORS, LTD., of Winnipeg, Man., Can., has been incorporated with a capital stock of $500,000. The directors are: Norton Griffiths, James K. Bock, Edward Paulet, Viscount Fielding and L. G. Bristowe, all of London, Eng.

THE HEXTER MOTOR TRUCK COMPANY, of New York, N. Y., has been chartered by Arthur A. Alexander, A. T. Rook, Maurice Milimet, all of 51 Chambers Street, New York, N. Y. The company is capitalized at $10,000 and proposes to manufacture motor trucks, cars, etc.

E. S. LINCOLN—R. W. P. BROWN, INC., of Brookline, Mass., has filed articles of incorporation with a capital stock of $250,000 for the purpose of doing an electrical engineering business. The incorporators are: Edwin S. Lincoln, Reginald W. P. Brown and Arthur T. Johnson.

E. L. PHILLIPS & COMPANY, of New York, N. Y., has been incorporated by Ellis L. Phillips and Warren M. Heim, both of 50 Church Street, New York, N. Y., and Henry R. Frost, 52 Broadway, New York, N. Y. The company is capitalized at $100,000 and proposes to do a general contracting and engineering business.

THE F. A. SMITH MANUFACTURING COMPANY, of Rochester, N. Y., has been chartered with a capital stock of $35,000 to manufacture oil, gas and electric fixtures and supplies. The incorporators are: F. A. Smith, F. S. Smith and C. E. Furman, of Rochester, N. Y.

New Incorporations.

NIAGARA FALLS, N. Y.—Articles of incorporation have been filed for the Frontier Power Transmission Company with a capital stock of $100,000. The company proposes to generate and sell power in Buffalo, Niagara Falls, Tonawanda, Wheatfield and La Salle. James S. Simmons, of Niagara Falls, is interested in the company.

COLUMBUS, OHIO.—The Radio Manufacturing Company has been incorporated with a capital stock of $50,000 by E. W. Brinker, J. C. Spangler, Howard Lewis, Chester C. Moelchert and J. H. Carpenter. The company proposes to establish a plant to supply power for manufacturing purposes.

EBENSBURG, PA.—Charters have been granted by the State Department to seven electric companies to operate in Cambria County with offices at Ebensburg, as follows: Allegheny, Blacklick, Cresson, Gallitzin, Summerhill and Washington, to operate in districts of those names, and the Pioneer, of Portage. Each company is capitalized at $5,000. The incorporators are: Jacob Mann, James Collins Jones and Floyd W. Woodcock, of Philadelphia, Pa.

MENALLEN, R. D. BIGLERVILLE, PA.—The Menallen Electric Company has been granted a charter with a capital stock of $5,000 to operate in Menallen Township. The incorporators are: F. M. Balsinger and G. T. Smith, of Pittsburgh, Pa., and W. H. Larimer, of Wilkinsburg, Pa.

NANTY GLO, PA.—The Jackson Light, Heat & Power Company has been granted a charter with a capital stock of $5,000. The company has been operating a small plant and proposes to increase the output of same, work on which has already commenced. The incorporators are: E. Smith, M. B. Nairn and Thomas P. Burns, all of Nanty Glo.

Personal.

JUDGE DAVID D. HOAG, secretary of the Empire District Electric Company, Joplin, Mo., has returned from a four months' trip abroad.

PROF. J. D. HOFFMAN, of the school of mechanical engineering of Purdue University, Lafayette, Ind., has resigned to take up instructional work in the University of Nebraska.

MR. B. J. DENMAN, until recently senior engineer in the commercial department of the Edison Illuminating Company of Detroit, Mich., has been appointed assistant chief engineer in charge of the company's Delray generating station.

MR. W. K. FREUDENBERGER has been appointed chief engineer of the Public Service Commission of the State of Nevada. Mr. Freudenberger was previously electrical engineer of the Steptoe Valley Smelting & Mining Company, McGill, Nev.

MR. JOHN J. DECK has been elected vice-president of Dossert & Company, of New York, to fill the vacancy caused by the resignation of Mr. Charles A. Flynn. Mr. D. J. Fitch has been elected secretary and treasurer of the same company.

MR. N. A. BURGESS has been appointed attorney in charge of the General Electric Company's patent department at Washington, D. C., succeeding Mr. W. M. Fairfax, who has opened an office as patent expert and attorney in the McLachlin Building.

MR. H. T. PLUMB, formerly associate professor of electrical engineering in Purdue University, Lafayette, Ind., has resigned to join the Denver, Col., office of the General Electric Company, with which he has been associated during the last year on leave of absence.

MR. H. W. YOUNG, president of the Delta-Star Electric Company, Chicago, and sales manager of the Sangamo Electric Company, Springfield, Ill., is making a Western trip investigating the distribution and metering problems of companies selling electrical energy to mines, irrigation projects and small towns located along their high-tension transmission lines.

MR. ROBERT H. KUSS, chief assistant smoke inspector of the city of Chicago, has resigned to accept a position with a private concern. Mr. Kuss was chief assistant under Mr. Paul P. Bird, the former smoke inspector, and was in charge of the department during the interval between the resignation of Mr. Bird and the appointment of Mr. Monnett, the present inspector.

MR. D. A. HEGARTY was the guest of honor at a banquet given by professional and business men of Little Rock, Ark., July 26, as a tribute to his service for the past five years as general manager of the Little Rock Railway & Electric Company. Mr. Hegarty on Aug. 2 became general manager of the railway and lighting department of the New Orleans Railway & Light Company.

MR. GEORGE W. NASMYTH has been appointed instructor in physics at Cornell University. Mr. Nasmyth recently completed an exhaustive investigation of impact excitation phenomena covering the characteristics of short arcs between metal electrodes; the intensity of the Lepel arc oscillations as a function of the arc current capacity and inductance, and the frequency of the Lepel oscillations. The researches were conducted at Cornell University and recorded in the *Physical Review*.

MR. L. D. GIBBS, superintendent of advertising for the Edison Electric Illuminating Company of Boston, delivered an address at the out-door advertising session of the Associated Advertising Clubs of America's seventh annual convention, held in Boston, on Friday morning, August 4. He exhibited special slides showing about twenty of the largest and most distinctive electric signs in Boston in different phases of their flashes, which were thrown on the screen in such a manner as to resemble vividly the signs in actual operation.

MR. ERNEST A. EDKINS, of Chicago, has been appointed editor of the Question Box of the National Electric Light Association. Mr. Edkins is superintendent of the employment bureau as well as secretary of the advisory committee of the Commonwealth Edison Company. He is also editor of *The Edison Round Table*, and, as he possesses conspicuous literary ability as well as wide central-station knowledge, he is sure to perform a useful service for the industry in the arduous task which he has taken on his shoulders.

MR. CALVERT TOWNLEY, who recently resigned as vice-president of the Connecticut Company to become identified with the Westinghouse Electric & Manufacturing Company, has been appointed assistant to Mr. E. M. Herr, the recently elected president of the latter company. Mr. Townley, who was for six years closely identified with the electrification problems of the New York, New Haven & Hartford Railroad, was formerly with the Westinghouse Electric & Manufacturing Company. He is a member of the A. I. E. E. and served as manager from 1905 to 1908, and as vice-president from 1908 to 1910.

MR. WALTER CLYDE JONES, State Senator from the Fifth District in Chicago, has announced his candidacy for the Republican nomination for Governor of Illinois. Mr. Jones, who graduated from the engineering course in Iowa State College, was engaged in electrical enterprises in the earlier part of his career and was at one time president of the Chicago Electrical Association, which was afterward merged into the Electrical Section of the Western Society of Engineers. He was admitted to the bar in 1895 and has been active in politics. He is a member of the American Society of Mechanical Engineers and of the Electric Club of Chicago.

MR. R. B. STEARNS, of Chicago, has been appointed assistant general manager of the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company, in charge of the railway departments of those companies. Mr. Stearns, who graduated from Purdue University, class of 1889, served on the engineering staff of the Columbian Exposition at Chicago in 1893. He was engaged in the United States Engineer Service on the Chicago Drainage Canal and the Hennepin Canal during the early history of these works, and from its inception took part in the construction of the Northwestern Elevated Railroad, the Union Loop and the extensions to the Lake Street (now Chicago & Oak Park Elevated Railroad), Chicago, as assistant chief engineer and superintendent of construction, subsequently becoming chief engineer and superintendent in charge of the operation of the Northwestern Elevated Railroad. Mr. Stearns was, for a short time before and during the receivership, general manager of the Chicago & Milwaukee Electric Railroad Company.

MR. THOMAS A. EDISON sailed for Europe by the Cunarder *Mauretania* on Aug. 2, accompanied by his son Charles, and will meet Mrs. Edison and their daughter in London. It is over a score of years since Mr. Edison last crossed the Atlantic, although many pressing and urgent invitations have reached him in the meantime, including one from a great English university, which desired to confer a degree on him. Close application to work in his laboratory kept Mr. Edison from taking his usual winter rest at his home in Florida, and for that reason Mrs. Edison was able to prevail on him to join her in Europe this summer. The matter of a large order for his storage batteries to be used on German submarines will also receive attention. The batteries are to be made in Germany, and part of the time will be spent in automobiling in that country. Mr. Edison is planning to return home about the last week in September. The occasion of the last visit of Mr. Edison to Europe was the Paris Exposition of 1900, and during his stay in Paris he was the recipient of almost royal attentions. Upon going to the Opéra one night, the management, apprised of his coming, had the orchestra play "The Star-Spangled Banner" upon his entry, while the audience greeted him with enthusiastic applause.

MR. D. L. GASKILL, President of the Greenville Electric Light & Power Company, of Greenville, Ohio, was re-elected secretary of the Ohio Electric Light Association at its Cedar Point convention, July 28, in testimony to his active and untiring services to the association. Besides perfecting the numerous details of registration, program and entertainment for the Cedar Point convention, the attendance at which reached 400 persons, Secretary Gaskill presented two of the papers at the convention which attracted the greatest interest, his report on "Insurance Rates Charged Electric-Lighting Companies in Ohio" and his constructive criticism of Ohio's new public-utility law. Mr. Gaskill was also re-elected secretary of the National District Heating Association at the time of the recent convention of that body, which was held in Pittsburgh, Pa.

D. L. GASKILL.

Trade Publications.

AUTOMOBILE CHARGING.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued Folder No. 4201, entitled "Charging the Automobile Battery with Westinghouse-Cooper Hewitt Rectifier Outfits." The folder is well illustrated and describes outfits and accessories.

COPPER-CLAD STEEL WIRE FOR TELEGRAPH SERVICE.—The Duplex Metals Company, Chester, Pa., has issued a bulletin containing a report on copper-clad steel wire for telegraph service. The report summarizes the principal conclusions from an exhaustive investigation on the subject by a well-known engineer.

BUSHINGS.—The Federal Sign System, Chicago, Ill., has sent out a card with a sample of its lock clamp bushings for outlet boxes and all metal work. The bushing, which is made of porcelain, has a non-rusting metal-clamping ring. It is firmly attached by means of a few twists, and is approved by the Underwriters.

SHOP BUILDINGS.—The Stone & Webster Engineering Corporation, Boston, Mass., has issued an illustrated folder showing two large reinforced-concrete buildings at Schenectady, N. Y., designed and erected for the General Electric Company by it. The buildings were built on a fee basis, and have a total floor space of seven and one-half acres.

INSTRUMENTS OF PRECISION.—A number of leaflets have been issued by H. Tinsley & Company, Eldon Park, South Norwood, England, for standard instruments, such as volt boxes for use with potentiometer, single and polyphase wattmeters, vibration galvanometer, non-inductive, low-resistance, standard shunts, Weston normal cells and universal potentiometers.

ELECTRIC SIGN FLASHERS.—Bulletin No. 14 issued by the Reynolds Electric Flasher Manufacturing Company, Chicago, Ill., contains suggestions and original ideas for spectacular flashing effects. The "Reco" flashers are made in eleven distinct types, and very often all are embodied in the construction of a combination flasher in order to obtain a realistic effect. Electric signs showing steaming tea, dancing bear, flames and pin wheel, bursting rocket, winding and unwinding disk, motion pictures, water effects, etc., are shown.

BUSINESS NOTES.

THE MOLONEY ELECTRIC COMPANY has removed its Chicago offices from the Fisher Building to 332 South Michigan Boulevard (528 McCormick Building).

RUDEL-BELNAP MACHINERY COMPANY.—Mr. L. J. Belnap has resigned as Montreal manager of the Allis-Chalmers-Bullock Company, Montreal, after having been connected with the Allis-Chalmers interests for the past ten years. Mr. Belnap has organized the Rudel-Belnap Machinery Company, Ltd., Canadian Express Building, Montreal. The company will carry general machine shop and contractors' equipments, and have charge of the Montreal office of the Canadian Crocker-Wheeler Company.

PACIFIC COAST AGENCY OF STEEL CITY ELECTRIC COMPANY.—The Steel City Electric Company, of Pittsburgh, Pa., has appointed the Aylsworth Agencies Company, 143 Second Street, San Francisco, Cal., as its sales representative for the Pacific Coast. The Aylsworth company will carry a stock of the various Steel City products, including "Star" bushings, "Steel City" drawn-steel outlet boxes, "Fullman" adjustable and non-adjustable floor outlets, "Universal' insulator supports, "Star" fixture stems, "Superior" fish wire, etc.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, has consummated arrangements with the Mine & Smelter Supply Company by which the latter concern will act as representative for the Wagner company in the territory tributary to Denver, Salt Lake City, El Paso and Mexico City. In each instance the Mine & Smelter headquarters virtually becomes a district office of the Wagner company, and will carry a satisfactory stock and be equipped with the necessary sales and engineering staff to negotiate for the sale and installation of Wagner apparatus. Mr. O. H. Davidson, heretofore Wagner representative at Denver, becomes head of the electrical department of the Denver house of the Mine & Smelter Supply Company. In Salt Lake City Mr. F. E. Marcey, for several years manager of the Salt Lake City office of the Allis-Chalmers Company, is manager of the Mine & Smelter Supply Company's office.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Annual convention in November, 1911.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next semi-annual meeting at Toronto, Canada, September 21-23, 1911.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York. Next meeting at Philadelphia, Pa., Sept. 5, 6 and 7, 1911.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual convention, Atlantic City, N. J., October 9-13, 1911.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Thorpe, Little Rock, Ark.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago. Next annual meeting (Hotel La Salle, Chicago), November 6 to 10, 1911. Semi-annual meeting, Washington, 1911.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, F. D. Morris, 323 Hagerman Building, Colorado Springs, Col. Annual convention, Glenwood Springs, Col., Sept. 13-15, 1911.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d St., New York. Meetings, fourth Tuesday of each month.

ELECTRIC CLUB, CHICAGO. Secretary, N. F. Obright, 1500 American Trust Bldg., Chicago. Meets every Wednesday noon, 303 Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago. Annual meeting, Chicago, Nov. 2, 1911.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of directors meets second Thursday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago. Annual convention, Sept. 25-27, 1911, Chicago, Ill.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind. Annual meeting, Aug. 23 and 24, 1911.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Next convention at Ryan Hotel, St. Paul, Minn., Sept. 12-15, 1911.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary James D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., Sept. 21 and 22, 1911.

MAINE ELECTRICAL ASSOCIATION. Secretary, Walter S. Hyman, Waterville, Maine.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, T. C. Gordon, Little Falls, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham. Springfield Gas & Electric Co., Springfield, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., probably first week in June, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 39 Boylston St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, PENNSYLVANIA SECTION. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

NATIONAL ELECTRIC INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 343 Marquette Bldg., Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Joseph B. Ware, Grand Rapids, Mich.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. I. E. Sanborn, Ohio State University, Columbus, Ohio.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill. Annual meeting, Denver, Col., Oct. 16-18, 1911.

PITTSBURGH ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, D. G. Fisher, 1316 Commerce St., Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

VERMONT ELECTRICAL ASSOCIATION. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Next annual meeting, Milwaukee, January, 1912.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 25, 1911.
[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

998,594. GALVANOMETER; F. Aronson, Evanston, Ill. App. filed Sept. 16, 1910. The permanent magnet is rotarily adjustable with respect to the oscillating coil.

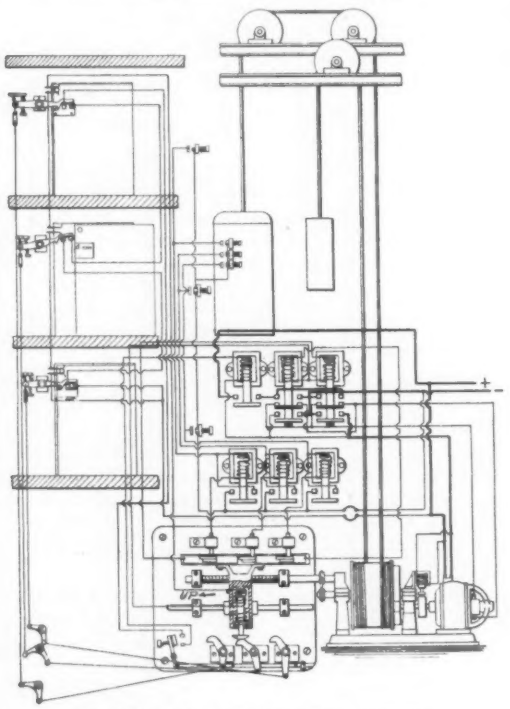
998,618. STEREOSCOPE-PLATE CHANGER; E. W. Kelly, Philadelphia, Pa. App. filed Aug. 1, 1910. A plurality of plate holders and a "tunnel." The holders are opaque to ordinary light and translucent to X-rays.

998,624. DOOR-LOCK-OPERATING APPARATUS; A. Magnuson, New York, N. Y. App. filed Nov. 14, 1907. For automatically controlled elevator systems. The latch-operating device is automatically operated when the car is opposite the door.

998,635. ARMATURE; B. P. and F. I. Remy, Anderson, Ind. App. filed Aug. 19, 1909. The core is formed in two parts to be clamped on opposite sides of a continuous shaft and each part has a form-wound coil. For magnetic ignition, etc.

998,647. ELECTROMAGNETIC CONTROL SYSTEM; H. L. Smith, Schenectady, N. Y. App. filed Oct. 27, 1909. For automatically filling a tank from which fluid is drawn in large quantities and at frequent intervals.

998,649. INSULATOR BRACKET FOR ELECTRICAL WORK; F. K. Spencer and O. Bennett, Binghamton, N. Y. App. filed Nov. 11, 1910. Vertical and horizontal plates for insulator support.



998,624—Door-Lock-Operating Apparatus.

998,653. FLOOR CONTROLLER; A. Sundh, Yonkers, N. Y. App. filed Nov. 11, 1907. For elevators. This door-lock-operating mechanism is remote from the car and connected mechanically to the locks. Adjustable contacts for varying the position at which the car stops.

998,662. CIRCUIT-CONTROLLING DEVICE; J. B. Wiard, Lynn, Mass. App. filed March 25, 1907. Actuated by fluid pressure to control a single-phase motor for operating blowers, pumps, etc.

998,665. REFINING METALS; W. C. Arsem, Schenectady, N. Y. App. filed Feb. 9, 1910. Silver is distilled from a mixture of gold and silver in a substantial vacuum at about 1300 deg. C.

998,674. GUARD ATTACHMENT FOR TROLLEYS; G. J. Burns, Youngstown, Ohio. App. filed Aug. 17, 1910. Pivoted and weighted angle levers on each side of the wheel.

998,677. DYNAMO-ELECTRIC MACHINE; W. F. Dawson, Schenectady, N. Y. App. filed Dec. 19, 1904. A ring secures the commutator bars in fixed relation to the support. Some bars are short and others long and widened to facilitate connection.

998,687. ARC-LAMP ELECTRODE; E. J. Guay, Lynn, Mass. App. filed June 26, 1909. Titanium carbide containing between 1 per cent and 6 per cent of free sulphur to diminish spitting and prevent the particles from fusing with glass.

998,705. TELEPHONE-EXCHANGE SYSTEM; R. H. Manson, Elyria, Ohio. App. filed Feb. 19, 1910. Automatic clear-out set by hanging up the receiver; cut-off relays in the cord circuits, one being a time relay.

998,749. TREATMENT OF PRECIOUS METALLIFEROUS ORES; J. C. Clancy, New York, N. Y. App. filed March 17, 1910. The ore is subjected to a thiocyanate solution containing a soluble cyanide and a soluble iodine compound and electrolyzer.

998,766. ELECTRIC CONDUCTOR SUPPORT; W. E. Foote, Everett, Mass. App. filed May 11, 1911. A turn-out for an overhead trolley wire. The switch member is removable.

998,786. ELECTRIC SWITCH; C. Loeffler, Utica, N. Y. App. filed March 1, 1907. All connections are behind the front panel and operated by a lever with toggle connections to rods possing through the panel.

998,810. COMBINED TAPLET OR CROSSOVER AND RECEPTACLE; J. S. Stewart, New York, N. Y. App. filed March 23, 1910. Special-shaped porcelain with grooves to be used with moldings.

998,827. FLEXIBLE CONDUIT; U. S. Armstrong, New Kensington, Pa. App. filed Aug. 8, 1910. Two interlocked helical metal coils with a gasket strip between the layers.

998,849. ELECTRIC LANTERN; T. M. Jenks and A. W. Knutson, Galesburg, Ill. App. filed April 22, 1910. Has a hinged bail and automatic switch for lighting the lamp when the bail is raised.

998,850. AUTOMATIC STEREOSCOPIC RADIOGRAPHY; E. W. Kelly, Philadelphia, Pa. App. filed April 5, 1911. Process and apparatus. The source of X-rays and the plate are shifted after a time to produce the effect.

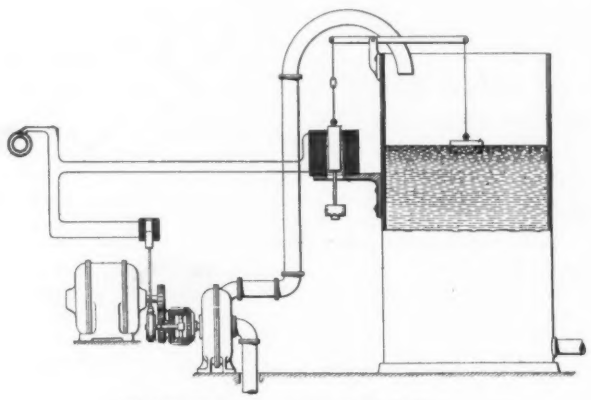
998,865. CAST ELECTRODE; K. Tornberg, Lynn, Mass. App. filed Dec. 28, 1910. One or more perforated shells anchoring the electrode material.

998,868. INDUCTION MOTOR; M. O. Berthold, Indianapolis, Ind. App. filed June 5, 1908. Longitudinally extending conducting bars contact with and project beyond short-circuiting rings adjacent to the core ends, and conducting rings engage the bar ends.

998,892. SPARK-COIL; A. J. Gifford, J. J. Burns and B. S. T. Bishop, Worcester, Mass. App. filed Nov. 6, 1908. Division from Patent No. 933,246, for gas engines, etc. A spring-pressed plunger for holding unit coils in a receptable. Contact and vibrator details.

998,895. ELECTRIC LAMP; W. A. Harvey, Scranton, Pa. App. filed Sept. 13, 1910. A reflector provides a re-entrant wall spacing apart a number of cells.

998,922. CLAMPING AND SUPPORTING MECHANISM; F. C. Peck, Wayne, Pa. App. filed Feb. 5, 1910. Two jaws are drawn together by a nut for holding a trolley wire.



998,647—Electromagnetic Control System.

998,925. CIRCUIT-CONTROLLING APPARATUS; W. M. Scott, Philadelphia, Pa. App. filed Nov. 27, 1908. A switch may be operated by a solenoid from a distance.

998,945. STARTING HEATER FOR CARBURETORS; C. W. Avery and F. E. Searle, Detroit, Mich. App. filed Nov. 25, 1910. Electric heater attachment for supplying the carburetor with hot air.

998,982. METHOD OF PRODUCING HALOGEN-OXYGEN COMPOUNDS BY ELECTROLYSIS; M. Pier, Berlin, Germany. App. filed April 29, 1911. The evolved chlorine gas escapes and is absorbed by tetrachloride of carbon and afterward returned to the electrolyte.

998,987. CARBON CAP; C. Recker, Oakville, Conn. App. filed April 21, 1911. A screw is riveted to a sheet-metal socket.

998,990. CIRCUIT-BREAKER; M. P. Ryder, White Plains, N. Y. App. filed April 9, 1904. For long-continued excess of current. Magnetic circuit-breaker coils and a fuse in shunt relation on the secondary of a transformer.

999,019. COOLING DEVICE FOR TELEPHONE TRANSMITTERS; C. E. Eggner and J. G. Holmstrom, Stockholm, Sweden. App. filed Nov. 2, 1910. Electrodes in direct contact with a high-resistance cooling liquid, such as alcohol, oil or distilled water.

999,108. MEANS FOR PREVENTING RUST IN BOILERS; A. S. Hickey. App. filed Dec. 31, 1910. A headed zinc rod is secured in a headed, hollow, threaded bolt and a cap fits over the bolt and rod. To be used in inaccessible places.

Reissue. 13,277. ELECTROLYTIC CELL; G. O. Seward and F. Von Kügelgen, East Orange, N. J. and Holcombs, Va. App. filed May 19, 1911. Original Patent No. 842,256. A plurality of water-cooled curtains are insulated from one another to form a non-conductive partition.